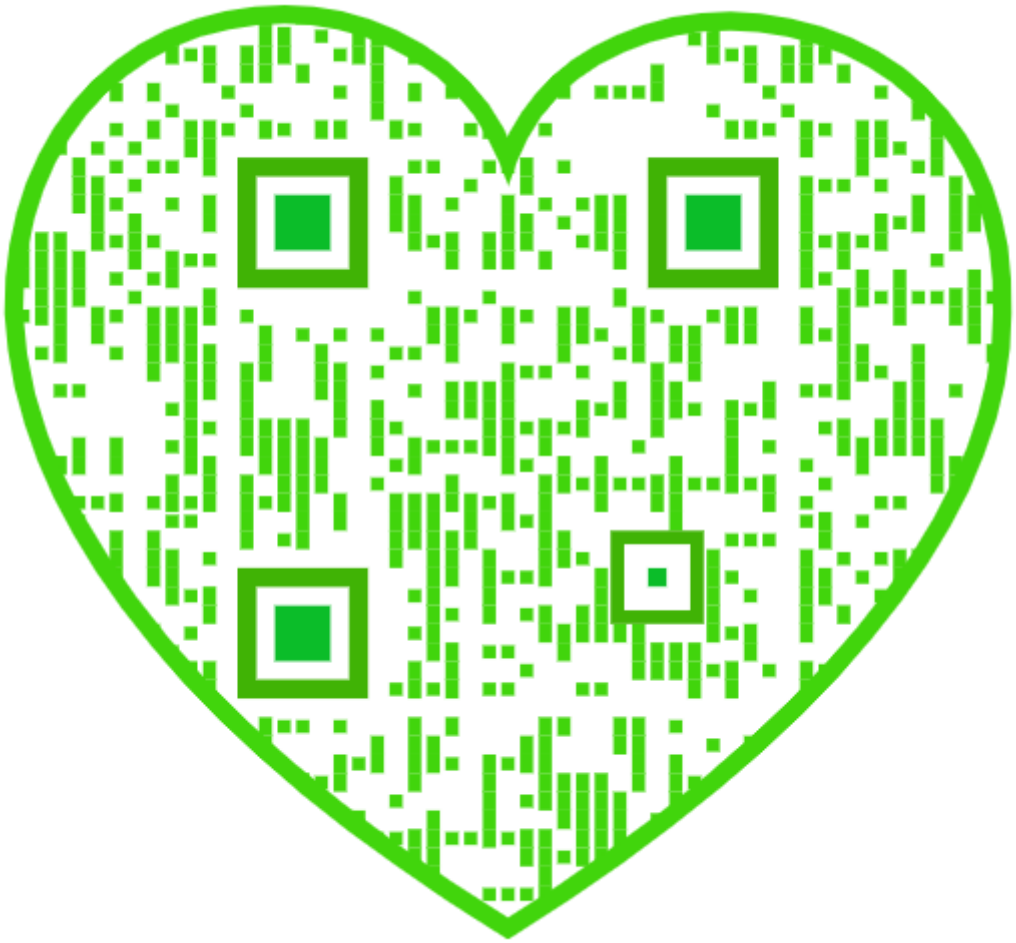
SEXTON'S
BOILER-MAKERS'
Pocket Book.



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Sep.	..	..	..	1	2	3	4
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SEXTON'S POCKET-BOOK

FOR

BOILER-MAKERS AND STEAM USERS.

COMPRISING A VARIETY OF

USEFUL INFORMATION

FOR

EMPLOYER AND WORKMAN, GOVERNMENT INSPECTORS,
BOARD OF TRADE SURVEYORS,
ENGINEERS IN CHARGE OF WORKS AND SHIPS,
FOREMEN OF MANUFACTORIES,
AND THE GENERAL STEAM-USING PUBLIC.

BY

MAURICE JOHN SEXTON.

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PREFACE.

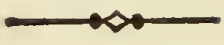
It is customary with authors to apologise for offering a new work to the public, and if an apology is in this case necessary, it is that I am only supplying a want that has been long and earnestly felt. Several years ago I compiled a Pocket-Book of Tables for my own use, to avoid having to make long calculations the moment they were wanted, and thereby risk the occurrence of a mistake. To these I have added the results of upwards of twenty years' experience amongst the manufacture and working of Boilers, the last ten years of this time being occupied as foreman boiler-maker in one of the most prominent London firms. Many of my scientific friends, to whom I have shown my Pocket-Book, have assured me that it is in their

opinion the book most urgently needed at the present time, and that it is simply my duty to offer it to the public. In compiling these pages, I have studiously endeavoured to confine myself to my own profession, and not to interfere with any book already existing. I sincerely hope that the contents of these pages may prove beneficial to the reader, and that the interests of no person may suffer.

MAURICE JOHN SEXTON.

Millwall, London.

INTRODUCTION.



Few manufactures, if any, should be conducted under conditions so strictly systematic as that of Boiler-making; and there are no workmen to whom it is a greater matter of necessity to be familiar with the laws of Nature, as they immediately affect their trade, than Boiler-makers. The number of steam boilers that prematurely wear out, or explode with more or less destruction to life or property—such explosions or premature decay being entirely or partially attributable to insufficient knowledge on the part of the workman or his superintendent—is difficult to estimate; and it will be readily admitted by those who are at all acquainted with the subject, that working Boiler-makers, and in many instances their foremen, are very imperfectly instructed in the extremely dif-

ficult duties they have to perform. It is, indeed, a matter of no little surprise that a plain and practical work on Boiler-making has never before been written; but perhaps the reason is, that men who attain proficiency in so very laborious an occupation have no taste for devoting their very limited leisure time to writing; and that those whose circumstances have enabled them to become acquainted with the theory of Boiler-making have for equal reasons been precluded from acquiring a practical knowledge that is only to be obtained by years of hard work and close observation. This little book is intended to remedy this defect, or fill this void in the flow of much needed instruction; and as the writer has, in common with thousands of others, often felt the need of a pocket-book of reference like the present, he has endeavoured to make it all that could be desired to give the mechanic a thorough knowledge of his business, whereby he will save himself much trouble and anxiety, and in very many instances the time and material of his employer.

STEAM USERS

also will find this work very useful, as it will show them where to look for hidden defects, and their cause and means of prevention; and, indeed, many persons would be startled if they were aware of the strain put upon their boilers in trying to make one part fit the other that has never been properly prepared to receive it, and which depends entirely upon the elasticity of the iron to force or drag parts together, which a very little extra pressure would cause to fly asunder. This unfortunately has more than once occurred, when, it is usual to say, the boiler was constructed by one of the best makers; was tested to so much more than the working pressure; was fitted with all the latest improvements; had a sufficient supply of water at the time of the explosion; and as the safety valves were found to have been properly adjusted, the cause of the accident must be owing to some mysterious action of the water inside the boiler. In conclusion, algebraic signs will not be used in this work. All abstruseness or ambiguity will be

avoided; and really the possessor will not have to make any calculations—a thing to be always avoided during the hurry and excitement of working hours—but will find in the following pages an answer to every question that, in the ordinary course of business, can possibly suggest itself.

SEXTON'S

Pocket-Book for Boiler-Makers.

CYLINDRICAL BOILERS.

The single tube cylindrical boiler is called the Cornish boiler; and the diameter of the tube, as a rule, should be equal to half the diameter of the shell, which the outside part of the boiler is generally called; thus, a boiler 5 ft. diameter should have its tube 2 ft. 6 in., and the tube should be fixed so as to leave about 6 in. between the bottom of it and the bottom of the shell. If the distance is greater than that, there will be too much inactive water at the bottom of the boiler; and if the distance is less, the ends of the boiler are liable to become cracked at the bottom, because when the boiler is at work, the top of the tube becomes hotter than the bottom, and the tube in general hotter than the shell. This causes it to expand, or become longer than the shell, and also to assume an upward curvature; the consequence of this action being that the ends of the boiler are forced out at the top and bent to an angle more or less at the bottom; hence if the space between the bottom of the shell and the tube is too small, that part of the end plate is liable to crack through being too rigid; from the same reason that if we take a piece of hoop-iron, say a foot long, we may bend it until the two ends come together, and again straighten it a great many times before it

will break; but if we do the same with a piece 6 in. long it will break much sooner. Again, if we take a piece only an inch long it will probably break the first time. The end of the boiler is constantly undergoing a similar motion, though of course in a lesser degree; and this explains a result often found inside a boiler, which has been variously attributed to galvanic action, the action of salts, &c., contained in the water, and in fact to many causes except the true one; it is this: the end of a new boiler is like Fig. 1 inside, but sometimes, after being in use for some time, it is found to be rapidly decaying, as Fig. 2, the cause is, that the end is not sufficiently flexible, the bending process that must take place somewhere, instead of being distributed over a moderately large area, occurs all in one or two places, and consequently with greater abruptness; therefore, each time the plate or angle iron is bent a bit of rust falls off and a new bit commences to form, and thus the change from Fig. 1 to Fig. 2 is effected.

Fig. 1.

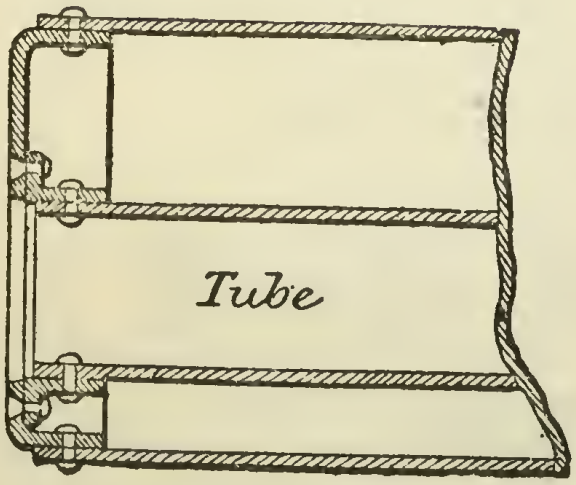
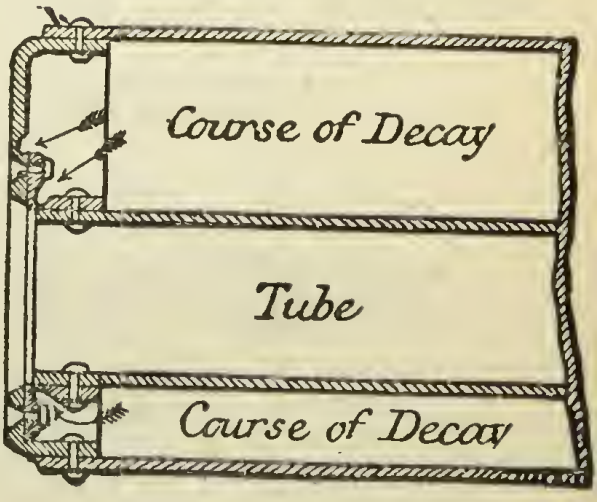
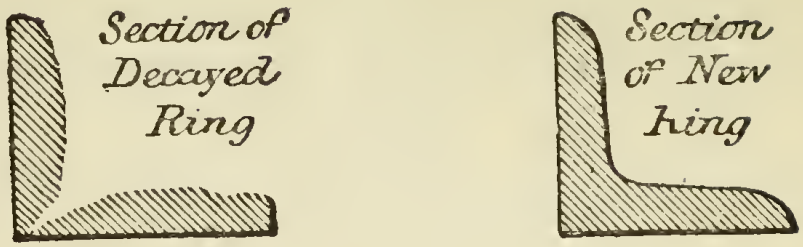


Fig. 2.



Very often the angle-iron ring round the end of the tube breaks completely through at that part most exposed to the bending motion, and usually presents the appearance of Fig. 3.

Fig. 3.



When the order is given for a new boiler, the outside dimensions are generally supplied; but if the given diameter be such that the circumference amounts to an odd inch or part of an inch, increase or reduce it to even inches in the outside ring of plates, it will make no perceptible difference in the diameter of the boiler; thus, if the given diameter amounts to 18 ft. $7\frac{1}{4}$ in. in circumference, make it 18 ft. 8 in.; the advantages are these, the plates can be punched to a regular distance of 2 in. between the centres of the rivet-holes, which, as a rule, is the distance they should be on the outside rings, thus only one template need be made instead of two; or where a punching-table is used, only one-half the number of plates need be punched by the rack, a matter that will often prevent serious mistakes. Secondly, this is a rule that can never be forgotten if once adopted; and if a new plate is at any time wanted to be put in the boiler, the size and pitch of holes are unmistakable, the new plate can be got ready before the

old one is cut out, and upon the removal of the old one the new one can be put in its place, without that annoying loss of time occupied in straightening the old one, laying it on and marking the new one from it. Persons who have ever had their boilers repaired will readily see the advantage of this system. Observe the same rule with regard to the length of the boiler, viz., have all the holes 2 in. pitch: if the given length is 20 ft. make it 19 ft. 8 in. from the centre of the holes at one end to the same at the other end; the distance from the centre of the holes to outside each end-plate will be $2\frac{1}{4}$ in., making the total length of the boiler 20 ft. $0\frac{1}{2}$ in., or half an inch over the given length, which is of no consequence whatever, and will save all the time that is wasted in trying to divide equally a fraction of an inch into a number of feet with a pair of compasses, which has to be repeated over and over again when once commenced. The inner ring of plates must be six and a half times its thickness less in circumference than the outer one; thus, if the outer ring is 18 ft. 8 in. in circumference, and the plates $\frac{1}{2}$ in. thick, the inner ring must be $3\frac{1}{4}$ in. less, viz., 18 ft. $4\frac{3}{4}$ in. in circumference. This rule applies to all circumferences; it would be $3\frac{1}{4}$ in. in a circumference of 100 ft., or one of 2 ft. if the plates were $\frac{1}{2}$ in. thick: for $\frac{3}{8}$ in. plates it would be $2\frac{7}{16}$ in., &c. If sufficient reduction was not made, the workmen, when putting the boiler together, would find the inside plates a little too long, or the outside a little too short; in other words, he would have bad holes. To avoid blame upon the same being discovered, he would probably drift the seams together as rapidly and forcibly as possible,

which process would partially fracture the rivet-holes, and upon the boiler being at work for a time, the too well known "seam rip" would probably occur, of which the cause is very often misunderstood.

The circumference of a circle is three times, and the one-tenth the four-hundredth; the one-thousandth and six ten-thousandth times its diameter; hence, to find the circumference of a circle multiply the diameter by the decimal figures 3·1416; but as the size of circles of boiler-plate varies according to the thickness, that must be added to or taken from the diameter, according as the given diameter is inside or outside the circle. Example: what is the circumference of a tube 2 ft. $11\frac{1}{2}$ in. inside diameter, of $\frac{1}{2}$ in. plate; add the thickness to the diameter, which makes 3 ft., and multiply as explained, thus:—

$$\begin{array}{r} 3{\cdot}1416 \\ 3 \\ \hline 9{\cdot}4248 \end{array}$$

Answer, a little over 9 ft. 5 in.

The following are tables of circumferences of circles of plate of from 10 in. to 80 ft. diameter of the $\frac{1}{16}$th in. plate which will be found useful in making gasometers, and from 10 in. to 8 ft. in the others; the thicknesses advance by a $\frac{1}{16}$th, from $\frac{1}{16}$th to $\frac{1}{2}$ in. and the diameters advance by $\frac{1}{8}$th of an inch.

The sizes here given are in all cases the outside diameters. The circumferences are from centre to centre of holes round, or allowing the two ends to come together, no allowance being made for over-lap or welding.

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter.

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
0	10	2	$7\frac{1}{4}$	1	1	3	$4\frac{9}{16}$	1	4	4	$2\frac{1}{16}$	1	7	4	$11\frac{1}{2}$	1	10	5	9
0	$10\frac{1}{8}$	2	$7\frac{5}{8}$	1	$1\frac{1}{8}$	3	$4\frac{15}{16}$	1	$4\frac{1}{8}$	4	$2\frac{7}{16}$	1	$7\frac{1}{8}$	4	$11\frac{7}{8}$	1	$10\frac{1}{8}$	5	$9\frac{7}{16}$
0	$10\frac{1}{4}$	2	8	1	$1\frac{1}{4}$	3	$5\frac{7}{16}$	1	$4\frac{1}{4}$	4	$2\frac{7}{8}$	1	$7\frac{1}{4}$	5	$0\frac{5}{16}$	1	$10\frac{1}{4}$	5	$9\frac{15}{16}$
0	$10\frac{3}{8}$	2	$8\frac{7}{16}$	1	$1\frac{3}{8}$	3	$5\frac{13}{16}$	1	$4\frac{3}{8}$	4	$3\frac{3}{16}$	1	$7\frac{3}{8}$	5	$0\frac{5}{8}$	1	$10\frac{3}{8}$	5	$10\frac{1}{4}$
0	$10\frac{1}{2}$	2	$8\frac{7}{8}$	1	$1\frac{1}{2}$	3	$6\frac{3}{16}$	1	$4\frac{1}{2}$	4	$3\frac{11}{16}$	1	$7\frac{1}{2}$	5	$1\frac{3}{32}$	1	$10\frac{1}{2}$	5	$10\frac{11}{16}$
0	$10\frac{5}{8}$	2	$9\frac{3}{16}$	1	$1\frac{5}{8}$	3	$6\frac{9}{16}$	1	$4\frac{5}{8}$	4	$3\frac{15}{16}$	1	$7\frac{5}{8}$	5	$1\frac{7}{16}$	1	$10\frac{5}{8}$	5	11
0	$10\frac{3}{4}$	2	$9\frac{5}{8}$	1	$1\frac{3}{4}$	3	$6\frac{15}{16}$	1	$4\frac{3}{4}$	4	$4\frac{5}{16}$	1	$7\frac{3}{4}$	5	$1\frac{13}{16}$	1	$10\frac{3}{4}$	5	$11\frac{7}{16}$
0	$10\frac{7}{8}$	2	$9\frac{15}{16}$	1	$1\frac{7}{8}$	3	$7\frac{5}{16}$	1	$4\frac{7}{8}$	4	$4\frac{11}{16}$	1	$7\frac{7}{8}$	5	$2\frac{1}{4}$	1	$10\frac{7}{8}$	5	$11\frac{3}{4}$
0	11	2	$10\frac{3}{8}$	1	2	3	$7\frac{3}{4}$	1	5	4	$5\frac{1}{4}$	1	8	5	$2\frac{11}{16}$	1	11	6	$0\frac{1}{4}$
0	$11\frac{1}{8}$	2	$10\frac{11}{16}$	1	$2\frac{1}{8}$	3	$8\frac{3}{32}$	1	$5\frac{1}{8}$	4	$5\frac{9}{16}$	1	$8\frac{1}{8}$	5	$2\frac{15}{16}$	1	$11\frac{1}{8}$	6	$0\frac{11}{16}$
0	$11\frac{1}{4}$	2	$11\frac{1}{8}$	1	$2\frac{1}{4}$	3	$8\frac{9}{16}$	1	$5\frac{1}{4}$	4	6	1	$8\frac{1}{4}$	5	$3\frac{3}{8}$	1	$11\frac{1}{4}$	6	$1\frac{1}{16}$
0	$11\frac{3}{8}$	2	$11\frac{9}{16}$	1	$2\frac{3}{8}$	3	$8\frac{15}{16}$	1	$5\frac{3}{8}$	4	$6\frac{5}{16}$	1	$8\frac{3}{8}$	5	$3\frac{3}{4}$	1	$11\frac{3}{8}$	6	$1\frac{7}{16}$
0	$11\frac{1}{2}$	2	$11\frac{15}{16}$	1	$2\frac{1}{2}$	3	$9\frac{5}{16}$	1	$5\frac{1}{2}$	4	$6\frac{13}{16}$	1	$8\frac{1}{2}$	5	$4\frac{3}{16}$	1	$11\frac{1}{2}$	6	$1\frac{3}{4}$
0	$11\frac{5}{8}$	3	$0\frac{5}{16}$	1	$2\frac{5}{8}$	3	$9\frac{13}{16}$	1	$5\frac{5}{8}$	4	$7\frac{1}{8}$	1	$8\frac{5}{8}$	5	$4\frac{9}{16}$	1	$11\frac{5}{8}$	6	$2\frac{3}{16}$
0	$11\frac{3}{4}$	3	$0\frac{3}{4}$	1	$2\frac{3}{4}$	3	$10\frac{1}{8}$	1	$5\frac{3}{4}$	4	$7\frac{9}{16}$	1	$8\frac{3}{4}$	5	5	1	$11\frac{3}{4}$	6	$2\frac{9}{16}$
0	$11\frac{7}{8}$	3	$1\frac{1}{16}$	1	$2\frac{7}{8}$	3	$10\frac{9}{16}$	1	$5\frac{7}{8}$	4	$7\frac{15}{16}$	1	$8\frac{7}{8}$	5	$5\frac{5}{16}$	1	$11\frac{7}{8}$	6	$2\frac{15}{16}$
1	0	3	$1\frac{1}{2}$	1	3	3	$10\frac{15}{16}$	1	6	4	$8\frac{5}{16}$	1	9	5	$5\frac{13}{16}$	2	0	6	$3\frac{3}{8}$
1	$0\frac{1}{8}$	3	$1\frac{13}{16}$	1	$3\frac{1}{8}$	3	$11\frac{5}{16}$	1	$6\frac{1}{8}$	4	$8\frac{11}{16}$	1	$9\frac{1}{8}$	5	$6\frac{1}{8}$	2	$0\frac{1}{8}$	6	$3\frac{3}{4}$
1	$0\frac{1}{4}$	3	$2\frac{3}{16}$	1	$3\frac{1}{4}$	3	$11\frac{3}{4}$	1	$6\frac{1}{4}$	4	$9\frac{3}{32}$	1	$9\frac{1}{4}$	5	$6\frac{9}{16}$	2	$0\frac{1}{4}$	6	$4\frac{3}{16}$
1	$0\frac{3}{8}$	3	$2\frac{11}{16}$	1	$3\frac{3}{8}$	4	$0\frac{1}{8}$	1	$6\frac{3}{8}$	4	$9\frac{7}{16}$	1	$9\frac{3}{8}$	5	$6\frac{15}{16}$	2	$0\frac{3}{8}$	6	$4\frac{1}{2}$
1	$0\frac{1}{2}$	3	$3\frac{1}{16}$	1	$3\frac{1}{2}$	4	$0\frac{9}{16}$	1	$6\frac{1}{2}$	4	$9\frac{7}{8}$	1	$9\frac{1}{2}$	5	$7\frac{5}{16}$	2	$0\frac{1}{2}$	6	$4\frac{15}{16}$
1	$0\frac{5}{8}$	3	$3\frac{7}{16}$	1	$3\frac{5}{8}$	4	$0\frac{13}{16}$	1	$6\frac{5}{8}$	4	$10\frac{5}{16}$	1	$9\frac{5}{8}$	5	$7\frac{11}{16}$	2	$0\frac{5}{8}$	6	$5\frac{5}{16}$
1	$0\frac{3}{4}$	3	$3\frac{13}{16}$	1	$3\frac{3}{4}$	4	$1\frac{1}{8}$	1	$6\frac{3}{4}$	4	$10\frac{11}{16}$	1	$9\frac{3}{4}$	5	8	2	$0\frac{3}{4}$	6	$5\frac{11}{16}$
1	$0\frac{7}{8}$	3	$4\frac{3}{16}$	1	$3\frac{7}{8}$	4	$1\frac{9}{16}$	1	$6\frac{7}{8}$	4	$11\frac{1}{16}$	1	$9\frac{7}{8}$	5	$8\frac{7}{16}$	2	$0\frac{7}{8}$	6	$5\frac{15}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 $6\frac{5}{16}$	2 4	7 $3\frac{11}{16}$	2 7	8 $1\frac{3}{16}$	2 10	8 $10\frac{5}{8}$	3 1	9 $8\frac{1}{16}$
2 $1\frac{1}{8}$	6 $6\frac{11}{16}$	2 $4\frac{1}{8}$	7 $4\frac{1}{16}$	2 $7\frac{1}{8}$	8 $1\frac{9}{16}$	2 $10\frac{1}{8}$	8 $11\frac{1}{16}$	3 $1\frac{1}{8}$	9 $8\frac{7}{16}$
2 $1\frac{1}{4}$	6 $7\frac{3}{16}$	2 $4\frac{1}{4}$	7 $4\frac{7}{16}$	2 $7\frac{1}{4}$	8 $1\frac{15}{16}$	2 $10\frac{1}{4}$	8 $11\frac{3}{8}$	3 $1\frac{1}{4}$	9 $8\frac{13}{16}$
2 $1\frac{3}{8}$	6 $7\frac{7}{16}$	2 $4\frac{3}{8}$	7 $4\frac{7}{8}$	2 $7\frac{3}{8}$	8 $2\frac{5}{16}$	2 $10\frac{3}{8}$	8 $11\frac{3}{4}$	3 $1\frac{3}{8}$	9 $9\frac{3}{16}$
2 $1\frac{1}{2}$	6 $7\frac{13}{16}$	2 $4\frac{1}{2}$	7 $5\frac{5}{16}$	2 $7\frac{1}{2}$	8 $2\frac{11}{16}$	2 $10\frac{1}{2}$	9 $0\frac{3}{16}$	3 $1\frac{1}{2}$	9 $9\frac{5}{8}$
2 $1\frac{5}{8}$	6 $8\frac{1}{4}$	2 $4\frac{5}{8}$	7 $5\frac{11}{16}$	2 $7\frac{5}{8}$	8 $3\frac{1}{16}$	2 $10\frac{5}{8}$	9 $0\frac{9}{16}$	3 $1\frac{5}{8}$	9 10
2 $1\frac{3}{4}$	6 $8\frac{11}{16}$	2 $4\frac{3}{4}$	7 $6\frac{1}{16}$	2 $7\frac{3}{4}$	8 $3\frac{1}{2}$	2 $10\frac{3}{4}$	9 $0\frac{15}{16}$	3 $1\frac{3}{4}$	9 $10\frac{3}{8}$
2 $1\frac{7}{8}$	6 $9\frac{3}{32}$	2 $4\frac{7}{8}$	7 $6\frac{7}{16}$	2 $7\frac{7}{8}$	8 $3\frac{7}{8}$	2 $10\frac{7}{8}$	9 $1\frac{5}{16}$	3 $1\frac{7}{8}$	9 $10\frac{3}{4}$
2 2	6 $9\frac{1}{2}$	2 5	7 $6\frac{13}{16}$	2 8	8 $4\frac{5}{16}$	2 11	9 $1\frac{3}{4}$	3 2	9 $11\frac{1}{4}$
2 $2\frac{1}{8}$	6 $9\frac{7}{8}$	2 $5\frac{1}{8}$	7 $7\frac{3}{16}$	2 $8\frac{1}{8}$	8 $4\frac{11}{16}$	2 $11\frac{1}{8}$	9 $2\frac{1}{16}$	3 $2\frac{1}{8}$	9 $11\frac{5}{8}$
2 $2\frac{1}{4}$	6 $10\frac{3}{16}$	2 $5\frac{1}{4}$	7 $7\frac{9}{16}$	2 $8\frac{1}{4}$	8 $5\frac{1}{16}$	2 $11\frac{1}{4}$	9 $2\frac{1}{2}$	3 $2\frac{1}{4}$	10 $0\frac{1}{16}$
2 $2\frac{3}{8}$	6 $10\frac{5}{8}$	2 $5\frac{3}{8}$	7 $7\frac{15}{16}$	2 $8\frac{3}{8}$	8 $5\frac{7}{16}$	2 $11\frac{3}{8}$	9 $2\frac{15}{16}$	3 $2\frac{3}{8}$	10 $0\frac{5}{16}$
2 $2\frac{1}{2}$	6 $11\frac{1}{16}$	2 $5\frac{1}{2}$	7 $8\frac{3}{8}$	2 $8\frac{1}{2}$	8 $5\frac{7}{8}$	2 $11\frac{1}{2}$	9 $3\frac{5}{16}$	3 $2\frac{1}{2}$	10 $0\frac{11}{16}$
2 $2\frac{5}{8}$	6 $11\frac{7}{16}$	2 $5\frac{5}{8}$	7 $8\frac{13}{16}$	2 $8\frac{5}{8}$	8 $6\frac{3}{16}$	2 $11\frac{5}{8}$	9 $3\frac{11}{16}$	3 $2\frac{5}{8}$	10 $1\frac{1}{16}$
2 $2\frac{3}{4}$	6 $11\frac{7}{8}$	2 $5\frac{3}{4}$	7 $9\frac{3}{16}$	2 $8\frac{3}{4}$	8 $6\frac{9}{16}$	2 $11\frac{3}{4}$	9 $4\frac{1}{16}$	3 $2\frac{3}{4}$	10 $1\frac{7}{16}$
2 $2\frac{7}{8}$	7 $0\frac{3}{16}$	2 $5\frac{7}{8}$	7 $9\frac{9}{16}$	2 $8\frac{7}{8}$	8 $6\frac{15}{16}$	2 $11\frac{7}{8}$	9 $4\frac{7}{16}$	3 $2\frac{7}{8}$	10 $1\frac{7}{8}$
2 3	7 $0\frac{11}{16}$	2 6	7 10	2 9	8 $7\frac{3}{8}$	3 0	9 $4\frac{7}{8}$	3 3	10 $2\frac{5}{16}$
2 $3\frac{1}{8}$	7 $0\frac{15}{16}$	2 $6\frac{1}{8}$	7 $10\frac{7}{16}$	2 $9\frac{1}{8}$	8 $7\frac{13}{16}$	3 $0\frac{1}{8}$	9 $5\frac{1}{4}$	3 $3\frac{1}{8}$	10 $2\frac{11}{16}$
2 $3\frac{1}{4}$	7 $1\frac{5}{16}$	2 $6\frac{1}{4}$	7 $10\frac{13}{16}$	2 $9\frac{1}{4}$	8 $8\frac{1}{4}$	3 $0\frac{1}{4}$	9 $5\frac{11}{16}$	3 $3\frac{1}{4}$	10 $3\frac{1}{8}$
2 $3\frac{3}{8}$	7 $1\frac{3}{4}$	2 $6\frac{3}{8}$	7 $11\frac{3}{16}$	2 $9\frac{3}{8}$	8 $8\frac{5}{8}$	3 $0\frac{3}{8}$	9 $5\frac{15}{16}$	3 $3\frac{3}{8}$	10 $3\frac{1}{2}$
2 $3\frac{1}{2}$	7 $2\frac{3}{16}$	2 $6\frac{1}{2}$	7 $11\frac{5}{8}$	2 $9\frac{1}{2}$	8 9	3 $0\frac{1}{2}$	9 $6\frac{1}{2}$	3 $3\frac{1}{2}$	10 $3\frac{7}{8}$
2 $3\frac{5}{8}$	7 $2\frac{9}{16}$	2 $6\frac{5}{8}$	7 $11\frac{15}{16}$	2 $9\frac{5}{8}$	8 $9\frac{3}{8}$	3 $0\frac{5}{8}$	9 $6\frac{7}{8}$	3 $3\frac{5}{8}$	10 $4\frac{1}{4}$
2 $3\frac{3}{4}$	7 $2\frac{13}{16}$	2 $6\frac{3}{4}$	8 $0\frac{3}{8}$	2 $9\frac{3}{4}$	8 $9\frac{13}{16}$	3 $0\frac{3}{4}$	9 $7\frac{1}{4}$	3 $3\frac{3}{4}$	10 $4\frac{11}{16}$
2 $3\frac{7}{8}$	7 $3\frac{5}{16}$	2 $6\frac{7}{8}$	8 $0\frac{3}{4}$	2 $9\frac{7}{8}$	8 $10\frac{1}{4}$	3 $0\frac{7}{8}$	9 $7\frac{11}{16}$	3 $3\frac{7}{8}$	10 $5\frac{1}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 4	10 $5\frac{7}{16}$	3 7	11 $2\frac{7}{8}$	3 10	12 $0\frac{5}{16}$	4 1	12 $9\frac{3}{4}$	4 4	13 $7\frac{1}{8}$
3 4$\frac{1}{8}$	10 $5\frac{13}{16}$	3 7$\frac{1}{8}$	11 $3\frac{5}{16}$	3 10$\frac{1}{8}$	12 $0\frac{11}{16}$	4 1$\frac{1}{8}$	12 $10\frac{3}{16}$	4 4$\frac{1}{8}$	13 $7\frac{7}{16}$
3 4$\frac{1}{4}$	10 $6\frac{1}{4}$	3 7$\frac{1}{4}$	11 $3\frac{11}{16}$	3 10$\frac{1}{4}$	12 $1\frac{1}{16}$	4 1$\frac{1}{4}$	12 $10\frac{9}{16}$	4 4$\frac{1}{4}$	13 $7\frac{7}{8}$
3 4$\frac{3}{8}$	10 $6\frac{11}{16}$	3 7$\frac{3}{8}$	11 $4\frac{1}{16}$	3 10$\frac{3}{8}$	12 $1\frac{7}{16}$	4 1$\frac{3}{8}$	12 $10\frac{15}{16}$	4 4$\frac{3}{8}$	13 $8\frac{5}{16}$
3 4$\frac{1}{2}$	10 $7\frac{1}{16}$	3 7$\frac{1}{2}$	11 $4\frac{7}{16}$	3 10$\frac{1}{2}$	12 $1\frac{13}{16}$	4 1$\frac{1}{2}$	12 $11\frac{3}{8}$	4 4$\frac{1}{2}$	13 $8\frac{11}{16}$
3 4$\frac{5}{8}$	10 $7\frac{7}{16}$	3 7$\frac{5}{8}$	11 $4\frac{13}{16}$	3 10$\frac{5}{8}$	12 $2\frac{3}{16}$	4 1$\frac{5}{8}$	12 $11\frac{3}{4}$	4 4$\frac{5}{8}$	13 $9\frac{1}{8}$
3 4$\frac{3}{4}$	10 $7\frac{13}{16}$	3 7$\frac{3}{4}$	11 $5\frac{3}{16}$	3 10$\frac{3}{4}$	12 $2\frac{9}{16}$	4 1$\frac{3}{4}$	13 $0\frac{1}{16}$	4 4$\frac{3}{4}$	13 $9\frac{1}{2}$
3 4$\frac{7}{8}$	10 $8\frac{5}{16}$	3 7$\frac{7}{8}$	11 $5\frac{9}{16}$	3 10$\frac{7}{8}$	12 3	4 1$\frac{7}{8}$	13 $0\frac{7}{16}$	4 4$\frac{7}{8}$	13 $9\frac{7}{8}$
3 5	10 $8\frac{9}{16}$	3 8	11 6	3 11	12 $3\frac{7}{16}$	4 2	13 $0\frac{7}{8}$	4 5	13 $10\frac{5}{16}$
3 5$\frac{1}{8}$	10 $8\frac{15}{16}$	3 8$\frac{1}{8}$	11 $6\frac{7}{16}$	3 11$\frac{1}{8}$	12 $3\frac{13}{16}$	4 2$\frac{1}{8}$	13 $1\frac{5}{16}$	4 5$\frac{1}{8}$	13 $10\frac{11}{16}$
3 5$\frac{1}{4}$	10 $9\frac{5}{16}$	3 8$\frac{1}{4}$	11 $6\frac{13}{16}$	3 11$\frac{1}{4}$	12 $4\frac{3}{16}$	4 2$\frac{1}{4}$	13 $1\frac{11}{16}$	4 5$\frac{1}{4}$	13 $11\frac{1}{16}$
3 5$\frac{3}{8}$	10 $9\frac{11}{16}$	3 8$\frac{3}{8}$	11 $7\frac{3}{16}$	3 11$\frac{3}{8}$	12 $4\frac{9}{16}$	4 2$\frac{3}{8}$	13 $2\frac{1}{16}$	4 5$\frac{3}{8}$	13 $11\frac{7}{16}$
3 5$\frac{1}{2}$	10 $10\frac{1}{16}$	3 8$\frac{1}{2}$	11 $7\frac{9}{16}$	3 11$\frac{1}{2}$	12 $4\frac{15}{16}$	4 2$\frac{1}{2}$	13 $2\frac{7}{16}$	4 5$\frac{1}{2}$	13 $11\frac{13}{16}$
3 5$\frac{5}{8}$	10 $10\frac{7}{16}$	3 8$\frac{5}{8}$	11 $7\frac{15}{16}$	3 11$\frac{5}{8}$	12 $5\frac{5}{16}$	4 2$\frac{5}{8}$	13 $2\frac{13}{16}$	4 5$\frac{5}{8}$	14 $0\frac{3}{16}$
3 5$\frac{3}{4}$	10 $10\frac{7}{8}$	3 8$\frac{3}{4}$	11 $8\frac{5}{16}$	3 11$\frac{3}{4}$	12 $5\frac{3}{4}$	4 2$\frac{3}{4}$	13 $3\frac{3}{16}$	4 5$\frac{3}{4}$	14 $0\frac{5}{8}$
3 5$\frac{7}{8}$	10 $11\frac{5}{16}$	3 8$\frac{7}{8}$	11 $8\frac{3}{4}$	3 11$\frac{7}{8}$	12 $6\frac{3}{16}$	4 2$\frac{7}{8}$	13 $3\frac{9}{16}$	4 5$\frac{7}{8}$	14 $1\frac{1}{32}$
3 6	10 $11\frac{3}{4}$	3 9	11 $9\frac{3}{16}$	4 0	12 $6\frac{5}{8}$	4 3	13 4	4 6	14 $1\frac{7}{16}$
3 6$\frac{1}{8}$	11 $0\frac{3}{16}$	3 9$\frac{1}{8}$	11 $9\frac{9}{16}$	4 0$\frac{1}{8}$	12 7	4 3$\frac{1}{8}$	13 $4\frac{7}{16}$	4 6$\frac{1}{8}$	14 $1\frac{7}{8}$
3 6$\frac{1}{4}$	11 $0\frac{9}{16}$	3 9$\frac{1}{4}$	11 $9\frac{15}{16}$	4 0$\frac{1}{4}$	12 $7\frac{3}{8}$	4 3$\frac{1}{4}$	13 $4\frac{13}{16}$	4 6$\frac{1}{4}$	14 $2\frac{5}{16}$
3 6$\frac{3}{8}$	11 $0\frac{15}{16}$	3 9$\frac{3}{8}$	11 $10\frac{1}{8}$	4 0$\frac{3}{8}$	12 $7\frac{3}{4}$	4 3$\frac{3}{8}$	13 $5\frac{3}{16}$	4 6$\frac{3}{8}$	14 $2\frac{11}{16}$
3 6$\frac{1}{2}$	11 $1\frac{5}{16}$	3 9$\frac{1}{2}$	11 $10\frac{9}{16}$	4 0$\frac{1}{2}$	12 $8\frac{1}{16}$	4 3$\frac{1}{2}$	13 $5\frac{9}{16}$	4 6$\frac{1}{2}$	14 $3\frac{1}{16}$
3 6$\frac{5}{8}$	11 $1\frac{11}{16}$	3 9$\frac{5}{8}$	11 $10\frac{15}{16}$	4 0$\frac{5}{8}$	12 $8\frac{7}{16}$	4 3$\frac{5}{8}$	13 $5\frac{15}{16}$	4 6$\frac{5}{8}$	14 $3\frac{7}{16}$
3 6$\frac{3}{4}$	11 $2\frac{1}{8}$	3 9$\frac{3}{4}$	11 $11\frac{3}{8}$	4 0$\frac{3}{4}$	12 $8\frac{7}{8}$	4 3$\frac{3}{4}$	13 $6\frac{5}{16}$	4 6$\frac{3}{4}$	14 $3\frac{13}{16}$
3 6$\frac{7}{8}$	11 $2\frac{1}{2}$	3 9$\frac{7}{8}$	11 $11\frac{13}{16}$	4 0$\frac{7}{8}$	12 $9\frac{5}{16}$	4 3$\frac{7}{8}$	13 $6\frac{11}{16}$	4 6$\frac{7}{8}$	14 $4\frac{3}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
4 7	14 $4\frac{9}{16}$	4 10	15 2	5 1	15 $11\frac{7}{16}$	5 4	16 $8\frac{7}{8}$	5 7	17 $6\frac{1}{4}$
4 $7\frac{1}{8}$	14 5	4 $10\frac{1}{8}$	15 $2\frac{3}{8}$	5 $1\frac{1}{8}$	15 $11\frac{13}{16}$	5 $4\frac{1}{8}$	16 $9\frac{5}{16}$	5 $7\frac{1}{8}$	17 $6\frac{5}{8}$
4 $7\frac{1}{4}$	14 $5\frac{7}{16}$	4 $10\frac{1}{4}$	15 $2\frac{13}{16}$	5 $1\frac{1}{4}$	16 $0\frac{3}{16}$	5 $4\frac{1}{4}$	16 $9\frac{11}{16}$	5 $7\frac{1}{4}$	17 $7\frac{1}{16}$
4 $7\frac{3}{8}$	14 $5\frac{13}{16}$	4 $10\frac{3}{8}$	15 $3\frac{3}{16}$	5 $1\frac{3}{8}$	16 $0\frac{9}{16}$	5 $4\frac{3}{8}$	16 $10\frac{1}{16}$	5 $7\frac{3}{8}$	17 $7\frac{7}{16}$
4 $7\frac{1}{2}$	14 $6\frac{3}{16}$	4 $10\frac{1}{2}$	15 $3\frac{9}{16}$	5 $1\frac{1}{2}$	16 1	5 $4\frac{1}{2}$	16 $10\frac{7}{16}$	5 $7\frac{1}{2}$	17 $7\frac{7}{8}$
4 $7\frac{5}{8}$	14 $6\frac{9}{16}$	4 $10\frac{5}{8}$	15 4	5 $1\frac{5}{8}$	16 $1\frac{3}{8}$	5 $4\frac{5}{8}$	16 $10\frac{13}{16}$	5 $7\frac{5}{8}$	17 $8\frac{5}{16}$
4 $7\frac{3}{4}$	14 $6\frac{15}{16}$	4 $10\frac{3}{4}$	15 $4\frac{3}{8}$	5 $1\frac{3}{4}$	16 $1\frac{13}{16}$	5 $4\frac{3}{4}$	16 $11\frac{3}{16}$	5 $7\frac{3}{4}$	17 $8\frac{11}{16}$
4 $7\frac{7}{8}$	14 $7\frac{3}{8}$	4 $10\frac{7}{8}$	15 $4\frac{3}{4}$	5 $1\frac{7}{8}$	16 $2\frac{3}{16}$	5 $4\frac{7}{8}$	16 $11\frac{9}{16}$	5 $7\frac{7}{8}$	17 $9\frac{1}{16}$
4 8	14 $7\frac{3}{4}$	4 11	15 $5\frac{1}{8}$	5 2	16 $2\frac{9}{16}$	5 5	17 0	5 8	17 $9\frac{7}{16}$
4 $8\frac{1}{8}$	14 $8\frac{3}{16}$	4 $11\frac{1}{8}$	15 $5\frac{1}{2}$	5 $2\frac{1}{8}$	16 3	5 $5\frac{1}{8}$	17 $0\frac{7}{16}$	5 $8\frac{1}{8}$	17 $9\frac{13}{16}$
4 $8\frac{1}{4}$	14 $8\frac{9}{16}$	4 $11\frac{1}{4}$	15 $5\frac{7}{8}$	5 $2\frac{1}{4}$	16 $3\frac{7}{16}$	5 $5\frac{1}{4}$	17 $0\frac{13}{16}$	5 $8\frac{1}{4}$	17 $10\frac{3}{16}$
4 $8\frac{3}{8}$	14 $8\frac{15}{16}$	4 $11\frac{3}{8}$	15 $6\frac{5}{16}$	5 $2\frac{3}{8}$	16 $3\frac{13}{16}$	5 $5\frac{3}{8}$	17 $1\frac{3}{16}$	5 $8\frac{3}{8}$	17 $10\frac{9}{16}$
4 $8\frac{1}{2}$	14 $9\frac{5}{16}$	4 $11\frac{1}{2}$	15 $6\frac{3}{4}$	5 $2\frac{1}{2}$	16 $4\frac{3}{16}$	5 $5\frac{1}{2}$	17 $1\frac{9}{16}$	5 $8\frac{1}{2}$	17 11
4 $8\frac{5}{8}$	14 $9\frac{11}{16}$	4 $11\frac{5}{8}$	15 $7\frac{1}{8}$	5 $2\frac{5}{8}$	16 $4\frac{9}{16}$	5 $5\frac{5}{8}$	17 2	5 $8\frac{5}{8}$	17 $11\frac{3}{8}$
4 $8\frac{3}{4}$	14 $10\frac{1}{16}$	4 $11\frac{3}{4}$	15 $7\frac{1}{2}$	5 $2\frac{3}{4}$	16 $4\frac{15}{16}$	5 $5\frac{3}{4}$	17 $2\frac{3}{8}$	5 $8\frac{3}{4}$	17 $11\frac{13}{16}$
4 $8\frac{7}{8}$	14 $10\frac{7}{16}$	4 $11\frac{7}{8}$	15 $7\frac{7}{8}$	5 $2\frac{7}{8}$	16 $5\frac{5}{16}$	5 $5\frac{7}{8}$	17 $2\frac{3}{4}$	5 $8\frac{7}{8}$	18 $0\frac{3}{16}$
4 9	14 $10\frac{7}{8}$	5 0	15 $8\frac{1}{4}$	5 3	16 $5\frac{3}{4}$	5 6	17 $3\frac{1}{8}$	5 9	18 $0\frac{9}{16}$
4 $9\frac{1}{8}$	14 $11\frac{5}{16}$	5 $0\frac{1}{8}$	15 $8\frac{5}{8}$	5 $3\frac{1}{8}$	16 $6\frac{3}{16}$	5 $6\frac{1}{8}$	17 $3\frac{9}{16}$	5 $9\frac{1}{8}$	18 $0\frac{15}{16}$
4 $9\frac{1}{4}$	14 $11\frac{11}{16}$	5 $0\frac{1}{4}$	15 9	5 $3\frac{1}{4}$	16 $6\frac{9}{16}$	5 $6\frac{1}{4}$	17 $3\frac{15}{16}$	5 $9\frac{1}{4}$	18 $1\frac{5}{16}$
4 $9\frac{3}{8}$	15 $0\frac{1}{16}$	5 $0\frac{3}{8}$	15 $9\frac{7}{16}$	5 $3\frac{3}{8}$	16 $6\frac{15}{16}$	5 $6\frac{3}{8}$	17 $4\frac{5}{16}$	5 $9\frac{3}{8}$	18 $1\frac{11}{16}$
4 $9\frac{1}{2}$	15 $0\frac{7}{16}$	5 $0\frac{1}{2}$	15 $9\frac{7}{8}$	5 $3\frac{1}{2}$	16 $7\frac{5}{16}$	5 $6\frac{1}{2}$	17 $4\frac{3}{4}$	5 $9\frac{1}{2}$	18 $2\frac{1}{8}$
4 $9\frac{5}{8}$	15 $0\frac{13}{16}$	5 $0\frac{5}{8}$	15 $10\frac{5}{16}$	5 $3\frac{5}{8}$	16 $7\frac{11}{16}$	5 $6\frac{5}{8}$	17 $5\frac{1}{8}$	5 $9\frac{5}{8}$	18 $2\frac{9}{16}$
4 $9\frac{3}{4}$	15 $1\frac{3}{16}$	5 $0\frac{3}{4}$	15 $10\frac{11}{16}$	5 $3\frac{3}{4}$	16 $8\frac{1}{16}$	5 $6\frac{3}{4}$	17 $5\frac{1}{2}$	5 $9\frac{3}{4}$	18 $2\frac{15}{16}$
4 $9\frac{7}{8}$	15 $1\frac{9}{16}$	5 $0\frac{7}{8}$	15 $11\frac{1}{16}$	5 $3\frac{7}{8}$	16 $8\frac{7}{16}$	5 $6\frac{7}{8}$	17 $5\frac{7}{8}$	5 $9\frac{7}{8}$	18 $3\frac{5}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
5 10	18 3¾	6 1	19 1⅛	6 4	19 10 9/16	6 7	20 8	6 10	21 5⅜
5 10⅛	18 4⅛	6 1⅛	19 1½	6 4⅛	19 10 15/16	6 7⅛	20 8 7/16	6 10⅛	21 5 13/16
5 10¼	18 4 9/16	6 1¼	19 1 15/16	6 4¼	19 11 5/16	6 7¼	20 8 13/16	6 10¼	21 6 3/16
5 10⅜	18 4 15/16	6 1⅜	19 2 5/16	6 4⅜	19 11 11/16	6 7⅜	20 9 3/16	6 10⅜	21 6 9/16
5 10½	18 5 5/16	6 1½	19 2¾	6 4½	20 0⅛	6 7½	20 9 9/16	6 10½	21 6 15/16
5 10⅝	18 5 11/16	6 1⅝	19 3⅛	6 4⅝	20 0 9/16	6 7⅝	20 9 15/16	6 10⅝	21 7⅜
5 10¾	18 6 3/16	6 1¾	19 3½	6 4¾	20 0 15/16	6 7¾	20 10 5/16	6 10¾	21 7 13/16
5 10⅞	18 6 9/16	6 1⅞	19 3⅞	6 4⅞	20 1 5/16	6 7⅞	20 10 11/16	6 10⅞	21 8 3/16
5 11	18 6 15/16	6 2	19 4¼	6 5	20 1¾	6 8	20 11⅛	6 11	21 8 9/16
5 11⅛	18 7 5/16	6 2⅛	19 4 11/16	6 5⅛	20 2⅛	6 8⅛	20 11 9/16	6 11⅛	21 8 15/16
5 11¼	18 7 11/16	6 2¼	19 5 1/16	6 5¼	20 2½	6 8¼	20 11 15/16	6 11¼	21 9 5/16
5 11⅜	18 8 1/16	6 2⅜	19 5 7/16	6 5⅜	20 2⅞	6 8⅜	21 0 5/16	6 11⅜	21 9 11/16
5 11½	18 8 7/16	6 2½	19 5⅞	6 5½	20 3¼	6 8½	21 0 11/16	6 11½	21 10⅛
5 11⅝	18 8 13/16	6 2⅝	19 6 5/16	6 5⅝	20 3 1/16	6 8⅝	21 1 1/16	6 11⅝	21 10 9/16
5 11¾	18 9 3/16	6 2¾	19 6 11/16	6 5¾	20 4 1/16	6 8¾	21 1 7/16	6 11¾	21 10 15/16
5 11⅞	18 9 9/16	6 2⅞	19 7 1/16	6 5⅞	20 4 7/16	6 8⅞	21 1 13/16	6 11⅞	21 11 5/16
6 0	18 10	6 3	19 7 7/16	6 6	20 4 13/16	6 9	21 2¼	7 0	21 11 11/16
6 0⅛	18 10 7/16	6 3⅛	19 7 13/16	6 6⅛	20 5¼	6 9⅛	21 2⅝	7 0⅛	22 0 1/16
6 0¼	18 10 13/16	6 3¼	19 8 3/16	6 6¼	20 5⅝	6 9¼	21 3 1/16	7 0¼	22 0 7/16
6 0⅜	18 11 3/16	6 3⅜	19 8 9/16	6 6⅜	20 6	6 9⅜	21 3 7/16	7 0⅜	22 0 13/16
6 0½	18 11 9/16	6 3½	19 9	6 6½	20 6⅝	6 9½	21 3 13/16	7 0½	22 1¼
6 0⅝	19 0	6 3⅝	19 9 7/16	6 6⅝	20 6 13/16	6 9⅝	21 4¼	7 0⅝	22 1 11/16
6 0¾	19 0⅜	6 3¾	19 9 13/16	6 6¾	20 7 3/16	6 9¾	21 4⅝	7 0¾	22 2 1/16
6 0⅞	19 0¾	6 3⅞	19 10 3/16	6 6⅞	20 7 9/16	6 9⅞	21 5	7 0⅞	22 2 7/16

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
7 1	22 $2\frac{13}{16}$	7 4	23 $0\frac{1}{4}$	7 7	23 $9\frac{11}{16}$	7 10	24 $7\frac{1}{8}$	8 1	25 $4\frac{1}{2}$
7 $1\frac{1}{8}$	22 $3\frac{3}{8}$	7 $4\frac{1}{8}$	23 $0\frac{11}{16}$	7 $7\frac{1}{8}$	23 $10\frac{1}{16}$	7 $10\frac{1}{8}$	24 $7\frac{9}{16}$	8 $1\frac{1}{8}$	25 $4\frac{15}{16}$
7 $1\frac{1}{4}$	22 $3\frac{5}{8}$	7 $4\frac{1}{4}$	23 $1\frac{1}{16}$	7 $7\frac{1}{4}$	23 $10\frac{7}{16}$	7 $10\frac{1}{4}$	24 $7\frac{15}{16}$	8 $1\frac{1}{4}$	25 $5\frac{5}{16}$
7 $1\frac{3}{8}$	22 4	7 $4\frac{3}{8}$	23 $1\frac{7}{16}$	7 $7\frac{3}{8}$	23 $10\frac{13}{16}$	7 $10\frac{3}{8}$	24 $8\frac{5}{16}$	8 $1\frac{3}{8}$	25 $5\frac{11}{16}$
7 $1\frac{1}{2}$	22 $4\frac{3}{8}$	7 $4\frac{1}{2}$	23 $1\frac{13}{16}$	7 $7\frac{1}{2}$	23 $11\frac{1}{4}$	7 $10\frac{1}{2}$	24 $8\frac{11}{16}$	8 $1\frac{1}{2}$	25 6
7 $1\frac{5}{8}$	22 $4\frac{13}{16}$	7 $4\frac{5}{8}$	23 $2\frac{1}{4}$	7 $7\frac{5}{8}$	23 $11\frac{11}{16}$	7 $10\frac{5}{8}$	24 $9\frac{1}{16}$	8 $1\frac{5}{8}$	25 $6\frac{7}{16}$
7 $1\frac{3}{4}$	22 $5\frac{3}{16}$	7 $4\frac{3}{4}$	23 $2\frac{5}{8}$	7 $7\frac{3}{4}$	24 $0\frac{1}{16}$	7 $10\frac{3}{4}$	24 $9\frac{7}{16}$	8 $1\frac{3}{4}$	25 $6\frac{7}{8}$
7 $1\frac{7}{8}$	22 $5\frac{9}{16}$	7 $4\frac{7}{8}$	23 3	7 $7\frac{7}{8}$	24 $0\frac{7}{16}$	7 $10\frac{7}{8}$	24 $9\frac{13}{16}$	8 $1\frac{7}{8}$	25 $7\frac{5}{16}$
7 2	22 $5\frac{15}{16}$	7 5	23 $3\frac{3}{8}$	7 8	24 $0\frac{13}{16}$	7 11	24 $10\frac{1}{4}$	8 2	25 $7\frac{11}{16}$
7 $2\frac{1}{8}$	22 $6\frac{3}{16}$	7 $5\frac{1}{8}$	23 $3\frac{3}{4}$	7 $8\frac{1}{8}$	24 $1\frac{3}{16}$	7 $11\frac{1}{8}$	24 $10\frac{11}{16}$	8 $2\frac{1}{8}$	25 $8\frac{1}{16}$
7 $2\frac{1}{4}$	22 $6\frac{3}{4}$	7 $5\frac{1}{4}$	23 $4\frac{1}{16}$	7 $8\frac{1}{4}$	24 $1\frac{9}{16}$	7 $11\frac{1}{4}$	24 $11\frac{1}{16}$	8 $2\frac{1}{4}$	25 $8\frac{7}{16}$
7 $2\frac{3}{8}$	22 $7\frac{3}{16}$	7 $5\frac{3}{8}$	23 $4\frac{7}{16}$	7 $8\frac{3}{8}$	24 $1\frac{15}{16}$	7 $11\frac{3}{8}$	24 $11\frac{7}{16}$	8 $2\frac{3}{8}$	25 $8\frac{7}{8}$
7 $2\frac{1}{2}$	22 $7\frac{9}{16}$	7 $5\frac{1}{2}$	23 $4\frac{15}{16}$	7 $8\frac{1}{2}$	24 $2\frac{5}{8}$	7 $11\frac{1}{2}$	24 $11\frac{13}{16}$	8 $2\frac{1}{2}$	25 $9\frac{1}{4}$
7 $2\frac{5}{8}$	22 8	7 $5\frac{5}{8}$	23 $5\frac{3}{8}$	7 $8\frac{5}{8}$	24 $2\frac{13}{16}$	7 $11\frac{5}{8}$	25 $0\frac{3}{16}$	8 $2\frac{5}{8}$	25 $9\frac{5}{8}$
7 $2\frac{3}{4}$	22 $8\frac{3}{8}$	7 $5\frac{3}{4}$	23 $5\frac{13}{16}$	7 $8\frac{3}{4}$	24 $3\frac{3}{16}$	7 $11\frac{3}{4}$	25 $0\frac{9}{16}$	8 $2\frac{3}{4}$	25 $10\frac{1}{16}$
7 $2\frac{7}{8}$	22 $8\frac{3}{4}$	7 $5\frac{7}{8}$	23 $6\frac{3}{16}$	7 $8\frac{7}{8}$	24 $3\frac{9}{16}$	7 $11\frac{7}{8}$	25 $0\frac{15}{16}$	8 $2\frac{7}{8}$	25 $10\frac{7}{16}$
7 3	22 $9\frac{1}{8}$	7 6	23 $6\frac{9}{16}$	7 9	24 $3\frac{15}{16}$	8 0	25 $1\frac{3}{8}$	8 3	25 $10\frac{13}{16}$
7 $3\frac{1}{8}$	22 $9\frac{7}{16}$	7 $6\frac{1}{8}$	23 $6\frac{15}{16}$	7 $9\frac{1}{8}$	24 $4\frac{3}{8}$	8 $0\frac{1}{8}$	25 $1\frac{13}{16}$	8 $3\frac{1}{8}$	25 $11\frac{3}{16}$
7 $3\frac{1}{4}$	22 $9\frac{13}{16}$	7 $6\frac{1}{4}$	23 $7\frac{5}{16}$	7 $9\frac{1}{4}$	24 $4\frac{3}{4}$	8 $0\frac{1}{4}$	25 $2\frac{3}{16}$	8 $3\frac{1}{4}$	25 $11\frac{9}{16}$
7 $3\frac{3}{8}$	22 $10\frac{1}{4}$	7 $6\frac{3}{8}$	23 $7\frac{11}{16}$	7 $9\frac{3}{8}$	24 $5\frac{1}{8}$	8 $0\frac{3}{8}$	25 $2\frac{9}{16}$	8 $3\frac{3}{8}$	25 $11\frac{15}{16}$
7 $3\frac{1}{2}$	22 $10\frac{11}{16}$	7 $6\frac{1}{2}$	23 $8\frac{1}{2}$	7 $9\frac{1}{2}$	24 $5\frac{1}{2}$	8 $0\frac{1}{2}$	25 3	8 $3\frac{1}{2}$	26 $0\frac{3}{8}$
7 $3\frac{5}{8}$	22 $11\frac{1}{16}$	7 $6\frac{5}{8}$	23 $8\frac{9}{16}$	7 $9\frac{5}{8}$	24 $5\frac{13}{16}$	8 $0\frac{5}{8}$	25 $3\frac{3}{8}$	8 $3\frac{5}{8}$	26 $0\frac{3}{4}$
7 $3\frac{3}{4}$	22 $11\frac{7}{16}$	7 $6\frac{3}{4}$	23 $8\frac{15}{16}$	7 $9\frac{3}{4}$	24 $6\frac{1}{4}$	8 $0\frac{3}{4}$	25 $3\frac{3}{4}$	8 $3\frac{3}{4}$	26 $1\frac{3}{16}$
7 $3\frac{7}{8}$	22 $11\frac{15}{16}$	7 $6\frac{7}{8}$	23 $9\frac{5}{16}$	7 $9\frac{7}{8}$	24 $6\frac{11}{16}$	8 $0\frac{7}{8}$	25 $4\frac{1}{8}$	8 $3\frac{7}{8}$	26 $1\frac{9}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 80 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
8	4	26	$1\frac{15}{16}$	8	7	26	$11\frac{3}{8}$	8	10	27	$8\frac{13}{16}$	9	8	30	$4\frac{1}{4}$
8	$4\frac{1}{8}$	26	$2\frac{3}{8}$	8	$7\frac{1}{8}$	26	$11\frac{13}{16}$	8	$10\frac{1}{8}$	27	$9\frac{3}{16}$	9	9	30	$7\frac{3}{8}$
8	$4\frac{1}{4}$	26	$2\frac{3}{4}$	8	$7\frac{1}{4}$	27	$0\frac{3}{16}$	8	$10\frac{1}{4}$	27	$9\frac{9}{16}$	9	10	30	$10\frac{1}{2}$
8	$4\frac{3}{8}$	26	$3\frac{3}{16}$	8	$7\frac{3}{8}$	27	$0\frac{5}{8}$	8	$10\frac{3}{8}$	27	$9\frac{15}{16}$	9	11	31	$1\frac{5}{8}$
8	$4\frac{1}{2}$	26	$3\frac{9}{16}$	8	$7\frac{1}{2}$	27	$1\frac{1}{16}$	8	$10\frac{1}{2}$	27	$10\frac{3}{8}$	10	0	31	$4\frac{3}{4}$
8	$4\frac{5}{8}$	26	$3\frac{15}{16}$	8	$7\frac{5}{8}$	27	$1\frac{7}{16}$	8	$10\frac{5}{8}$	27	$10\frac{13}{16}$	11	0	34	$6\frac{11}{16}$
8	$4\frac{3}{4}$	26	$4\frac{5}{16}$	8	$7\frac{3}{4}$	27	$1\frac{13}{16}$	8	$10\frac{3}{4}$	27	$11\frac{3}{16}$	12	0	37	$7\frac{7}{8}$
8	$4\frac{7}{8}$	26	$4\frac{3}{4}$	8	$7\frac{7}{8}$	27	$2\frac{3}{16}$	8	$10\frac{7}{8}$	27	$11\frac{9}{16}$	13	0	40	$9\frac{7}{8}$
8	5	26	$5\frac{1}{8}$	8	8	27	$2\frac{1}{2}$	8	11	27	$11\frac{15}{16}$	14	0	43	$11\frac{5}{8}$
8	$5\frac{1}{8}$	26	$5\frac{9}{16}$	8	$8\frac{1}{8}$	27	$2\frac{7}{8}$	8	$11\frac{1}{8}$	28	$0\frac{3}{8}$	15	0	47	$1\frac{1}{4}$
8	$5\frac{1}{4}$	26	$5\frac{15}{16}$	8	$8\frac{1}{4}$	27	$3\frac{1}{4}$	8	$11\frac{1}{4}$	28	$0\frac{13}{16}$	16	0	50	3
8	$5\frac{3}{8}$	26	$6\frac{5}{16}$	8	$8\frac{3}{8}$	27	$3\frac{5}{8}$	8	$11\frac{3}{8}$	28	$1\frac{3}{16}$	17	0	53	$4\frac{11}{16}$
8	$5\frac{1}{2}$	26	$6\frac{11}{16}$	8	$8\frac{1}{2}$	27	$4\frac{1}{16}$	8	$11\frac{1}{2}$	28	$1\frac{9}{16}$	18	0	56	$6\frac{3}{8}$
8	$5\frac{5}{8}$	26	$7\frac{1}{16}$	8	$8\frac{5}{8}$	27	$4\frac{7}{16}$	8	$11\frac{5}{8}$	28	$1\frac{15}{16}$	19	0	59	$8\frac{1}{16}$
8	$5\frac{3}{4}$	26	$7\frac{7}{16}$	8	$8\frac{3}{4}$	27	$4\frac{13}{16}$	8	$11\frac{3}{4}$	28	$2\frac{3}{8}$	20	0	62	$9\frac{3}{4}$
8	$5\frac{7}{8}$	26	$7\frac{13}{16}$	8	$8\frac{7}{8}$	27	$5\frac{1}{4}$	8	$11\frac{7}{8}$	28	$2\frac{13}{16}$	25	0	78	$6\frac{1}{4}$
8	6	26	$8\frac{1}{4}$	8	9	27	$5\frac{11}{16}$	9	0	28	$3\frac{3}{16}$	30	0	94	$2\frac{3}{4}$
8	$6\frac{1}{8}$	26	$8\frac{5}{8}$	8	$9\frac{1}{8}$	27	$6\frac{1}{16}$	9	1	28	$7\frac{1}{8}$	35	0	109	$11\frac{1}{4}$
8	$6\frac{1}{4}$	26	9	8	$9\frac{1}{4}$	27	$6\frac{7}{16}$	9	2	28	$9\frac{3}{8}$	40	0	125	$7\frac{3}{4}$
8	$6\frac{3}{8}$	26	$9\frac{7}{16}$	8	$9\frac{3}{8}$	27	$6\frac{13}{16}$	9	3	29	$0\frac{1}{2}$	45	0	140	10
8	$6\frac{1}{2}$	26	$9\frac{13}{16}$	8	$9\frac{1}{2}$	27	$7\frac{1}{4}$	9	4	29	$3\frac{1}{16}$	50	0	157	$0\frac{3}{4}$
8	$6\frac{5}{8}$	26	$10\frac{3}{16}$	8	$9\frac{5}{8}$	27	$7\frac{5}{8}$	9	5	29	$6\frac{7}{8}$	60	0	188	5
8	$6\frac{3}{4}$	26	$10\frac{9}{16}$	8	$9\frac{3}{4}$	27	$8\frac{1}{16}$	9	6	29	$9\frac{15}{16}$	70	0	219	$10\frac{3}{4}$
8	$6\frac{7}{8}$	26	$10\frac{15}{16}$	8	$9\frac{7}{8}$	27	$8\frac{7}{16}$	9	7	30	$1\frac{1}{8}$	80	0	251	$3\frac{1}{4}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
0 10	2 $7\frac{1}{16}$	1 1	3 $4\frac{3}{8}$	1 4	4 $1\frac{7}{8}$	1 7	4 $11\frac{5}{16}$	1 10	5 $8\frac{3}{4}$
0 $10\frac{1}{8}$	2 $7\frac{7}{16}$	1 $1\frac{1}{8}$	3 $4\frac{13}{16}$	1 $4\frac{1}{8}$	4 $2\frac{5}{16}$	1 $7\frac{1}{8}$	4 $11\frac{11}{16}$	1 $10\frac{1}{8}$	5 $9\frac{1}{4}$
0 $10\frac{1}{4}$	2 $7\frac{13}{16}$	1 $1\frac{1}{4}$	3 $5\frac{1}{4}$	1 $4\frac{1}{4}$	4 $2\frac{11}{16}$	1 $7\frac{1}{4}$	5 $0\frac{1}{16}$	1 $10\frac{1}{4}$	5 $9\frac{11}{16}$
0 $10\frac{3}{8}$	2 $8\frac{1}{4}$	1 $1\frac{3}{8}$	3 $5\frac{5}{8}$	1 $4\frac{3}{8}$	4 3	1 $7\frac{3}{8}$	5 $0\frac{7}{16}$	1 $10\frac{3}{8}$	5 $10\frac{1}{16}$
0 $10\frac{1}{2}$	2 $8\frac{11}{16}$	1 $1\frac{1}{2}$	3 6	1 $4\frac{1}{2}$	4 $3\frac{7}{16}$	1 $7\frac{1}{2}$	5 $0\frac{15}{16}$	1 $10\frac{1}{2}$	5 $10\frac{1}{2}$
0 $10\frac{5}{8}$	2 9	1 $1\frac{5}{8}$	3 $6\frac{3}{8}$	1 $4\frac{5}{8}$	4 $3\frac{3}{4}$	1 $7\frac{5}{8}$	5 $1\frac{1}{4}$	1 $10\frac{5}{8}$	5 $10\frac{13}{16}$
0 $10\frac{3}{4}$	2 $9\frac{7}{16}$	1 $1\frac{3}{4}$	3 $6\frac{13}{16}$	1 $4\frac{3}{4}$	4 $4\frac{3}{16}$	1 $7\frac{3}{4}$	5 $1\frac{11}{16}$	1 $10\frac{3}{4}$	5 $11\frac{3}{16}$
0 $10\frac{7}{8}$	2 $9\frac{3}{4}$	1 $1\frac{7}{8}$	3 $7\frac{3}{16}$	1 $4\frac{7}{8}$	4 $4\frac{9}{16}$	1 $7\frac{7}{8}$	5 $2\frac{1}{16}$	1 $10\frac{7}{8}$	5 $11\frac{1}{2}$
0 11	2 $10\frac{3}{16}$	1 2	3 $7\frac{9}{16}$	1 5	4 $5\frac{1}{16}$	1 8	5 $2\frac{7}{16}$	1 11	6 $0\frac{1}{16}$
0 $11\frac{1}{8}$	2 $10\frac{1}{2}$	1 $2\frac{1}{8}$	3 $7\frac{15}{16}$	1 $5\frac{1}{8}$	4 $5\frac{7}{16}$	1 $8\frac{1}{8}$	5 $2\frac{13}{16}$	1 $11\frac{1}{8}$	6 $0\frac{7}{16}$
0 $11\frac{1}{4}$	2 $10\frac{15}{16}$	1 $2\frac{1}{4}$	3 $8\frac{7}{16}$	1 $5\frac{1}{4}$	4 $5\frac{13}{16}$	1 $8\frac{1}{4}$	5 $3\frac{3}{16}$	1 $11\frac{1}{4}$	6 $0\frac{7}{8}$
0 $11\frac{3}{8}$	2 $11\frac{3}{8}$	1 $2\frac{3}{8}$	3 $8\frac{3}{4}$	1 $5\frac{3}{8}$	4 $6\frac{1}{8}$	1 $8\frac{3}{8}$	5 $3\frac{9}{16}$	1 $11\frac{3}{8}$	6 $1\frac{1}{4}$
0 $11\frac{1}{2}$	2 $11\frac{3}{4}$	1 $2\frac{1}{2}$	3 $9\frac{3}{16}$	1 $5\frac{1}{2}$	4 $6\frac{9}{16}$	1 $8\frac{1}{2}$	5 $4\frac{1}{16}$	1 $11\frac{1}{2}$	6 $1\frac{9}{16}$
0 $11\frac{5}{8}$	3 $0\frac{1}{8}$	1 $2\frac{5}{8}$	3 $9\frac{5}{8}$	1 $5\frac{5}{8}$	4 $6\frac{15}{16}$	1 $8\frac{5}{8}$	5 $4\frac{7}{16}$	1 $11\frac{5}{8}$	6 $1\frac{15}{16}$
0 $11\frac{3}{4}$	3 $0\frac{9}{16}$	1 $2\frac{3}{4}$	3 $9\frac{15}{16}$	1 $5\frac{3}{4}$	4 $7\frac{7}{16}$	1 $8\frac{3}{4}$	5 $4\frac{13}{16}$	1 $11\frac{3}{4}$	6 $2\frac{5}{16}$
0 $11\frac{7}{8}$	3 $0\frac{7}{8}$	1 $2\frac{7}{8}$	3 $10\frac{3}{8}$	1 $5\frac{7}{8}$	4 $7\frac{3}{4}$	1 $8\frac{7}{8}$	5 $5\frac{1}{8}$	1 $11\frac{7}{8}$	6 $2\frac{11}{16}$
1 0	3 $1\frac{5}{16}$	1 3	3 $10\frac{3}{4}$	1 6	4 $8\frac{3}{16}$	1 9	5 $5\frac{9}{16}$	2 0	6 $3\frac{3}{16}$
1 $0\frac{1}{8}$	3 $1\frac{5}{8}$	1 $3\frac{1}{8}$	3 $11\frac{3}{16}$	1 $6\frac{1}{8}$	4 $8\frac{1}{2}$	1 $9\frac{1}{8}$	5 $5\frac{15}{16}$	2 $0\frac{1}{8}$	6 $3\frac{9}{16}$
1 $0\frac{1}{4}$	3 $2\frac{1}{32}$	1 $3\frac{1}{4}$	3 $11\frac{9}{16}$	1 $6\frac{1}{4}$	4 $8\frac{15}{16}$	1 $9\frac{1}{4}$	5 $6\frac{3}{8}$	2 $0\frac{1}{4}$	6 4
1 $0\frac{3}{8}$	3 $2\frac{1}{2}$	1 $3\frac{3}{8}$	3 $11\frac{15}{16}$	1 $6\frac{3}{8}$	4 $9\frac{3}{16}$	1 $9\frac{3}{8}$	5 $6\frac{3}{4}$	2 $0\frac{3}{8}$	6 $4\frac{3}{8}$
1 $0\frac{1}{2}$	3 $2\frac{7}{8}$	1 $3\frac{1}{2}$	4 $0\frac{5}{16}$	1 $6\frac{1}{2}$	4 $9\frac{11}{16}$	1 $9\frac{1}{2}$	5 $7\frac{3}{16}$	2 $0\frac{1}{2}$	6 $4\frac{3}{4}$
1 $0\frac{5}{8}$	3 $3\frac{1}{4}$	1 $3\frac{5}{8}$	4 $0\frac{5}{8}$	1 $6\frac{5}{8}$	4 $10\frac{1}{8}$	1 $9\frac{5}{8}$	5 $7\frac{1}{2}$	2 $0\frac{5}{8}$	6 $5\frac{1}{8}$
1 $0\frac{3}{4}$	3 $3\frac{5}{8}$	1 $3\frac{3}{4}$	4 $0\frac{15}{16}$	1 $6\frac{3}{4}$	4 $10\frac{9}{16}$	1 $9\frac{3}{4}$	5 $7\frac{15}{16}$	2 $0\frac{3}{4}$	6 $5\frac{1}{2}$
1 $0\frac{7}{8}$	3 4	1 $3\frac{7}{8}$	4 $1\frac{7}{16}$	1 $6\frac{7}{8}$	4 $10\frac{7}{8}$	1 $9\frac{7}{8}$	5 $8\frac{1}{4}$	2 $0\frac{7}{8}$	6 $5\frac{3}{4}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 $6\frac{1}{8}$	2 4	7 $3\frac{9}{16}$	2 7	8 $1\frac{1}{16}$	2 10	8 $10\frac{7}{16}$	3 1	9 $7\frac{7}{8}$
2 $1\frac{1}{8}$	6 $6\frac{1}{2}$	2 $4\frac{1}{8}$	7 $3\frac{7}{8}$	2 $7\frac{1}{8}$	8 $1\frac{3}{8}$	2 $10\frac{1}{8}$	8 $10\frac{7}{8}$	3 $1\frac{1}{8}$	9 $8\frac{1}{4}$
2 $1\frac{1}{4}$	6 $6\frac{15}{16}$	2 $4\frac{1}{4}$	7 $4\frac{1}{4}$	2 $7\frac{1}{4}$	8 $1\frac{3}{4}$	2 $10\frac{1}{4}$	8 $11\frac{3}{16}$	3 $1\frac{1}{4}$	9 $8\frac{11}{16}$
2 $1\frac{3}{8}$	6 $7\frac{1}{4}$	2 $4\frac{3}{8}$	7 $4\frac{11}{16}$	2 $7\frac{3}{8}$	8 $2\frac{1}{8}$	2 $10\frac{3}{8}$	8 $11\frac{9}{16}$	3 $1\frac{3}{8}$	9 9
2 $1\frac{1}{2}$	6 $7\frac{5}{8}$	2 $4\frac{1}{2}$	7 $5\frac{3}{16}$	2 $7\frac{1}{2}$	8 $2\frac{9}{16}$	2 $10\frac{1}{2}$	9 0	3 $1\frac{1}{2}$	9 $9\frac{7}{16}$
2 $1\frac{5}{8}$	6 $8\frac{1}{16}$	2 $4\frac{5}{8}$	7 $5\frac{1}{2}$	2 $7\frac{5}{8}$	8 $2\frac{7}{8}$	2 $10\frac{5}{8}$	9 $0\frac{3}{8}$	3 $1\frac{5}{8}$	9 $9\frac{13}{16}$
2 $1\frac{3}{4}$	6 $8\frac{1}{2}$	2 $4\frac{3}{4}$	7 $5\frac{7}{8}$	2 $7\frac{3}{4}$	8 $3\frac{5}{16}$	2 $10\frac{3}{4}$	9 $0\frac{3}{4}$	3 $1\frac{3}{4}$	9 $10\frac{3}{16}$
2 $1\frac{7}{8}$	6 $8\frac{15}{16}$	2 $4\frac{7}{8}$	7 $6\frac{3}{16}$	2 $7\frac{7}{8}$	8 $3\frac{11}{16}$	2 $10\frac{7}{8}$	9 $1\frac{1}{8}$	3 $1\frac{7}{8}$	9 $10\frac{9}{16}$
2 2	6 $9\frac{5}{16}$	2 5	7 $6\frac{5}{8}$	2 8	8 $4\frac{3}{16}$	2 11	9 $1\frac{9}{16}$	3 2	9 $11\frac{1}{16}$
2 $2\frac{1}{8}$	6 $9\frac{11}{16}$	2 $5\frac{1}{8}$	7 7	2 $8\frac{1}{8}$	8 $4\frac{1}{2}$	2 $11\frac{1}{8}$	9 $1\frac{7}{8}$	3 $2\frac{1}{8}$	9 $11\frac{7}{16}$
2 $2\frac{1}{4}$	6 $10\frac{1}{16}$	2 $5\frac{1}{4}$	7 $7\frac{3}{8}$	2 $8\frac{1}{4}$	8 $4\frac{7}{8}$	2 $11\frac{1}{4}$	9 $2\frac{5}{16}$	3 $2\frac{1}{4}$	9 $11\frac{13}{16}$
2 $2\frac{3}{8}$	6 $10\frac{7}{16}$	2 $5\frac{3}{8}$	7 $7\frac{3}{4}$	2 $8\frac{3}{8}$	8 $5\frac{1}{4}$	2 $11\frac{3}{8}$	9 $2\frac{3}{4}$	3 $2\frac{3}{8}$	10 $0\frac{1}{8}$
2 $2\frac{1}{2}$	6 $10\frac{7}{8}$	2 $5\frac{1}{2}$	7 $8\frac{1}{4}$	2 $8\frac{1}{2}$	8 $5\frac{11}{16}$	2 $11\frac{1}{2}$	9 $3\frac{1}{8}$	3 $2\frac{1}{2}$	10 $0\frac{7}{16}$
2 $2\frac{5}{8}$	6 $11\frac{1}{4}$	2 $5\frac{5}{8}$	7 $8\frac{5}{8}$	2 $8\frac{5}{8}$	8 6	2 $11\frac{5}{8}$	9 $3\frac{1}{2}$	3 $2\frac{5}{8}$	10 $0\frac{7}{8}$
2 $2\frac{3}{4}$	6 $11\frac{11}{16}$	2 $5\frac{3}{4}$	7 9	2 $8\frac{3}{4}$	8 $6\frac{3}{8}$	2 $11\frac{3}{4}$	9 $3\frac{7}{8}$	3 $2\frac{3}{4}$	10 $1\frac{1}{4}$
2 $2\frac{7}{8}$	7 $0\frac{1}{16}$	2 $5\frac{7}{8}$	7 $9\frac{3}{8}$	2 $8\frac{7}{8}$	8 $6\frac{3}{4}$	2 $11\frac{7}{8}$	9 $4\frac{1}{4}$	3 $2\frac{7}{8}$	10 $1\frac{11}{16}$
2 3	7 $0\frac{7}{16}$	2 6	7 $9\frac{13}{16}$	2 9	8 $7\frac{3}{16}$	3 0	9 $4\frac{11}{16}$	3 3	10 $2\frac{1}{8}$
2 $3\frac{1}{8}$	7 $0\frac{13}{16}$	2 $6\frac{1}{8}$	7 $10\frac{1}{4}$	2 $9\frac{1}{8}$	8 $7\frac{5}{8}$	3 $0\frac{1}{8}$	9 $5\frac{1}{16}$	3 $3\frac{1}{8}$	10 $2\frac{1}{2}$
2 $3\frac{1}{4}$	7 $1\frac{3}{16}$	2 $6\frac{1}{4}$	7 $10\frac{5}{8}$	2 $9\frac{1}{4}$	8 $8\frac{1}{16}$	3 $0\frac{1}{4}$	9 $5\frac{7}{16}$	3 $3\frac{1}{4}$	10 $2\frac{15}{16}$
2 $3\frac{3}{8}$	7 $1\frac{9}{16}$	2 $6\frac{3}{8}$	7 11	2 $9\frac{3}{8}$	8 $8\frac{7}{16}$	3 $0\frac{3}{8}$	9 $5\frac{13}{16}$	3 $3\frac{3}{8}$	10 $3\frac{3}{16}$
2 $3\frac{1}{2}$	7 $2\frac{1}{16}$	2 $6\frac{1}{2}$	7 $11\frac{7}{16}$	2 $9\frac{1}{2}$	8 $8\frac{13}{16}$	3 $0\frac{1}{2}$	9 $6\frac{5}{16}$	3 $3\frac{1}{2}$	10 $3\frac{9}{19}$
2 $3\frac{5}{8}$	7 $2\frac{3}{8}$	2 $6\frac{5}{8}$	7 $11\frac{13}{16}$	2 $9\frac{5}{8}$	8 $9\frac{3}{16}$	3 $0\frac{5}{8}$	9 $6\frac{11}{16}$	3 $3\frac{5}{8}$	10 $4\frac{1}{16}$
2 $3\frac{3}{4}$	7 $2\frac{3}{4}$	2 $6\frac{3}{4}$	8 $0\frac{3}{16}$	2 $9\frac{3}{4}$	8 $9\frac{5}{8}$	3 $0\frac{3}{4}$	9 $7\frac{1}{16}$	3 $3\frac{3}{4}$	10 $4\frac{1}{2}$
2 $3\frac{7}{8}$	7 $3\frac{3}{16}$	2 $6\frac{7}{8}$	8 $0\frac{9}{16}$	2 $9\frac{7}{8}$	8 $10\frac{1}{16}$	3 $0\frac{7}{8}$	9 $7\frac{1}{2}$	3 $3\frac{7}{8}$	10 $4\frac{7}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 4	10 $5\frac{5}{16}$	3 7	11 $2\frac{11}{16}$	3 10	12 $0\frac{1}{16}$	4 1	12 $9\frac{9}{16}$	4 4	13 $6\frac{13}{16}$
3 4$\frac{1}{8}$	10 $5\frac{3}{8}$	3 7$\frac{1}{8}$	11 $3\frac{1}{8}$	3 10$\frac{1}{8}$	12 $0\frac{1}{2}$	4 1$\frac{1}{8}$	12 10	4 4$\frac{1}{8}$	13 $7\frac{1}{4}$
3 4$\frac{1}{4}$	10 $6\frac{1}{16}$	3 7$\frac{1}{4}$	11 $3\frac{1}{2}$	3 10$\frac{1}{4}$	12 $0\frac{7}{8}$	4 1$\frac{1}{4}$	12 $10\frac{3}{8}$	4 4$\frac{1}{4}$	13 $7\frac{11}{16}$
3 4$\frac{3}{8}$	10 $6\frac{1}{2}$	3 7$\frac{3}{8}$	11 $3\frac{7}{8}$	3 10$\frac{3}{8}$	12 $1\frac{1}{4}$	4 1$\frac{3}{8}$	12 $10\frac{3}{4}$	4 4$\frac{3}{8}$	13 $8\frac{1}{8}$
3 4$\frac{1}{2}$	10 $6\frac{7}{8}$	3 7$\frac{1}{2}$	11 $4\frac{1}{4}$	3 10$\frac{1}{2}$	12 $1\frac{5}{8}$	4 1$\frac{1}{2}$	12 $11\frac{3}{16}$	4 4$\frac{1}{2}$	13 $8\frac{9}{16}$
3 4$\frac{5}{8}$	10 $7\frac{1}{4}$	3 7$\frac{5}{8}$	11 $4\frac{5}{8}$	3 10$\frac{5}{8}$	12 2	4 1$\frac{5}{8}$	12 $11\frac{9}{16}$	4 4$\frac{5}{8}$	13 $8\frac{15}{16}$
3 4$\frac{3}{4}$	10 $7\frac{11}{16}$	3 7$\frac{3}{4}$	11 5	3 10$\frac{3}{4}$	12 $2\frac{3}{8}$	4 1$\frac{3}{4}$	12 $11\frac{7}{8}$	4 4$\frac{3}{4}$	13 $9\frac{1}{4}$
3 4$\frac{7}{8}$	10 $8\frac{1}{8}$	3 7$\frac{7}{8}$	11 $5\frac{3}{8}$	3 10$\frac{7}{8}$	12 $2\frac{13}{16}$	4 1$\frac{7}{8}$	13 $0\frac{1}{4}$	4 4$\frac{7}{8}$	13 $9\frac{11}{16}$
3 5	10 $8\frac{7}{16}$	3 8	11 $5\frac{13}{16}$	3 11	12 $3\frac{1}{4}$	4 2	13 $0\frac{11}{16}$	4 5	13 $10\frac{1}{8}$
3 5$\frac{1}{8}$	10 $8\frac{3}{4}$	3 8$\frac{1}{8}$	11 $6\frac{1}{4}$	3 11$\frac{1}{8}$	12 $3\frac{5}{8}$	4 2$\frac{1}{8}$	13 $1\frac{1}{8}$	4 5$\frac{1}{8}$	13 $10\frac{1}{2}$
3 5$\frac{1}{4}$	10 $9\frac{1}{8}$	3 8$\frac{1}{4}$	11 $6\frac{3}{8}$	3 11$\frac{1}{4}$	12 4	4 2$\frac{1}{4}$	13 $1\frac{1}{2}$	4 5$\frac{1}{4}$	13 $10\frac{7}{8}$
3 5$\frac{3}{8}$	10 $9\frac{1}{2}$	3 8$\frac{3}{8}$	11 7	3 11$\frac{3}{8}$	12 $4\frac{3}{8}$	4 2$\frac{3}{8}$	13 $1\frac{7}{8}$	4 5$\frac{3}{8}$	13 $11\frac{1}{4}$
3 5$\frac{1}{2}$	10 $9\frac{7}{8}$	3 8$\frac{1}{2}$	11 $7\frac{3}{8}$	3 11$\frac{1}{2}$	12 $4\frac{3}{4}$	4 2$\frac{1}{2}$	13 $2\frac{1}{4}$	4 5$\frac{1}{2}$	13 $11\frac{5}{8}$
3 5$\frac{5}{8}$	10 $10\frac{1}{4}$	3 8$\frac{5}{8}$	11 $7\frac{3}{4}$	3 11$\frac{5}{8}$	12 $5\frac{1}{8}$	4 2$\frac{5}{8}$	13 $2\frac{5}{8}$	4 5$\frac{5}{8}$	14 0
3 5$\frac{3}{4}$	10 $10\frac{11}{16}$	3 8$\frac{3}{4}$	11 $8\frac{1}{8}$	3 11$\frac{3}{4}$	12 $5\frac{9}{16}$	4 2$\frac{3}{4}$	13 3	4 5$\frac{3}{4}$	14 $0\frac{7}{16}$
3 5$\frac{7}{8}$	10 $11\frac{1}{8}$	3 8$\frac{7}{8}$	11 $8\frac{9}{16}$	3 11$\frac{7}{8}$	12 6	4 2$\frac{7}{8}$	13 $3\frac{3}{8}$	4 5$\frac{7}{8}$	14 $0\frac{13}{16}$
3 6	10 $11\frac{9}{16}$	3 9	11 9	4 0	12 $6\frac{7}{16}$	4 3	13 $3\frac{13}{16}$	4 6	14 $1\frac{1}{4}$
3 6$\frac{1}{8}$	11 0	3 9$\frac{1}{8}$	11 $9\frac{3}{8}$	4 0$\frac{1}{8}$	12 $6\frac{13}{16}$	4 3$\frac{1}{8}$	13 $4\frac{1}{4}$	4 6$\frac{1}{8}$	14 $1\frac{11}{16}$
3 6$\frac{1}{4}$	11 $0\frac{3}{8}$	3 9$\frac{1}{4}$	11 $9\frac{3}{4}$	4 0$\frac{1}{4}$	12 $7\frac{3}{16}$	4 3$\frac{1}{4}$	13 $4\frac{5}{8}$	4 6$\frac{1}{4}$	14 $2\frac{1}{8}$
3 6$\frac{3}{8}$	11 $0\frac{3}{4}$	3 9$\frac{3}{8}$	11 $10\frac{1}{16}$	4 0$\frac{3}{8}$	12 $7\frac{9}{16}$	4 3$\frac{3}{8}$	13 5	4 6$\frac{3}{8}$	14 $2\frac{1}{2}$
3 6$\frac{1}{2}$	11 $1\frac{1}{8}$	3 9$\frac{1}{2}$	11 $10\frac{3}{8}$	4 0$\frac{1}{2}$	12 $7\frac{7}{8}$	4 3$\frac{1}{2}$	13 $5\frac{3}{8}$	4 6$\frac{1}{2}$	14 $2\frac{7}{8}$
3 6$\frac{5}{8}$	11 $1\frac{1}{2}$	3 9$\frac{5}{8}$	11 $10\frac{3}{4}$	4 0$\frac{5}{8}$	12 $8\frac{1}{4}$	4 3$\frac{5}{8}$	13 $5\frac{3}{4}$	4 6$\frac{5}{8}$	14 $3\frac{1}{4}$
3 6$\frac{3}{4}$	11 $1\frac{15}{16}$	3 9$\frac{3}{4}$	11 $11\frac{3}{16}$	4 0$\frac{3}{4}$	12 $8\frac{11}{16}$	4 3$\frac{3}{4}$	13 $6\frac{1}{8}$	4 6$\frac{3}{4}$	14 $3\frac{5}{8}$
3 6$\frac{7}{8}$	11 $2\frac{5}{16}$	3 9$\frac{7}{8}$	11 $11\frac{5}{8}$	4 0$\frac{7}{8}$	12 $9\frac{1}{8}$	4 3$\frac{7}{8}$	13 $6\frac{1}{2}$	4 6$\frac{7}{8}$	14 4

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
4 7	14 $4\frac{7}{16}$	4 10	15 $1\frac{13}{16}$	5 1	15 $11\frac{1}{4}$	5 4	16 $8\frac{11}{16}$	5 7	17 $6\frac{1}{16}$
4 $7\frac{1}{8}$	14 $4\frac{13}{16}$	4 $10\frac{1}{8}$	15 $2\frac{3}{16}$	5 $1\frac{1}{8}$	15 $11\frac{5}{8}$	5 $4\frac{1}{8}$	16 $9\frac{1}{8}$	5 $7\frac{1}{8}$	16 $6\frac{7}{16}$
4 $7\frac{1}{4}$	14 $5\frac{1}{4}$	4 $10\frac{1}{4}$	15 $2\frac{5}{8}$	5 $1\frac{1}{4}$	16 0	5 $4\frac{1}{4}$	16 $9\frac{1}{2}$	5 $7\frac{1}{4}$	17 $6\frac{7}{8}$
4 $7\frac{3}{8}$	14 $5\frac{5}{8}$	4 $10\frac{3}{8}$	15 3	5 $1\frac{3}{8}$	16 $0\frac{3}{8}$	5 $4\frac{3}{8}$	16 $9\frac{7}{8}$	5 $7\frac{3}{8}$	17 $7\frac{1}{4}$
4 $7\frac{1}{2}$	14 6	4 $10\frac{1}{2}$	15 $3\frac{3}{8}$	5 $1\frac{1}{2}$	16 $0\frac{13}{16}$	5 $4\frac{1}{2}$	16 $10\frac{1}{4}$	5 $7\frac{1}{2}$	17 $7\frac{11}{16}$
4 $7\frac{5}{8}$	14 $6\frac{3}{8}$	4 $10\frac{5}{8}$	15 $3\frac{13}{16}$	5 $1\frac{5}{8}$	16 $1\frac{3}{16}$	5 $4\frac{5}{8}$	16 $10\frac{5}{8}$	5 $7\frac{5}{8}$	17 $8\frac{1}{8}$
4 $7\frac{3}{4}$	14 $6\frac{13}{16}$	4 $10\frac{3}{4}$	15 $4\frac{3}{16}$	5 $1\frac{3}{4}$	16 $1\frac{5}{8}$	5 $4\frac{3}{4}$	16 11	5 $7\frac{3}{4}$	17 $8\frac{1}{2}$
4 $7\frac{7}{8}$	14 $7\frac{3}{16}$	4 $10\frac{7}{8}$	15 $4\frac{9}{16}$	5 $1\frac{7}{8}$	16 2	5 $4\frac{7}{8}$	16 $11\frac{7}{16}$	5 $7\frac{7}{8}$	17 $8\frac{7}{8}$
4 8	14 $7\frac{9}{16}$	4 11	15 $4\frac{15}{16}$	5 2	16 $2\frac{7}{16}$	5 5	16 $11\frac{13}{16}$	5 8	17 $9\frac{1}{4}$
4 $8\frac{1}{8}$	14 8	4 $11\frac{1}{8}$	15 $5\frac{5}{16}$	5 $2\frac{1}{8}$	16 $2\frac{13}{16}$	5 $5\frac{1}{8}$	17 $0\frac{1}{4}$	5 $8\frac{1}{8}$	17 $9\frac{5}{8}$
4 $8\frac{1}{4}$	14 $8\frac{3}{8}$	4 $11\frac{1}{4}$	15 $5\frac{11}{16}$	5 $2\frac{1}{4}$	16 $3\frac{1}{4}$	5 $5\frac{1}{4}$	17 $0\frac{5}{8}$	5 $8\frac{1}{4}$	17 10
4 $8\frac{3}{8}$	14 $8\frac{3}{4}$	4 $11\frac{3}{8}$	15 $6\frac{1}{8}$	5 $2\frac{3}{8}$	16 $3\frac{5}{8}$	5 $5\frac{3}{8}$	17 1	5 $8\frac{3}{8}$	17 $10\frac{3}{8}$
4 $8\frac{1}{2}$	14 $9\frac{1}{8}$	4 $11\frac{1}{2}$	15 $6\frac{9}{16}$	5 $2\frac{1}{2}$	16 4	5 $5\frac{1}{2}$	17 $1\frac{7}{16}$	5 $8\frac{1}{2}$	17 $10\frac{13}{16}$
4 $8\frac{5}{8}$	14 $9\frac{1}{2}$	4 $11\frac{5}{8}$	15 $6\frac{15}{16}$	5 $2\frac{5}{8}$	16 $4\frac{3}{8}$	5 $5\frac{5}{8}$	17 $1\frac{13}{16}$	5 $8\frac{5}{8}$	17 $11\frac{1}{4}$
4 $8\frac{3}{4}$	14 $9\frac{7}{8}$	4 $11\frac{3}{4}$	15 $7\frac{5}{16}$	5 $2\frac{3}{4}$	16 $4\frac{3}{4}$	5 $5\frac{3}{4}$	17 $2\frac{3}{16}$	5 $8\frac{3}{4}$	17 $11\frac{5}{8}$
4 $8\frac{7}{8}$	14 $10\frac{1}{4}$	4 $11\frac{7}{8}$	15 $7\frac{11}{16}$	5 $2\frac{7}{8}$	16 $5\frac{3}{16}$	5 $5\frac{7}{8}$	17 $2\frac{9}{16}$	5 $8\frac{7}{8}$	18 0
4 9	14 $10\frac{11}{16}$	5 0	15 $8\frac{1}{16}$	5 3	16 $5\frac{9}{16}$	5 6	17 $2\frac{15}{16}$	5 9	18 $0\frac{3}{8}$
4 $9\frac{1}{8}$	14 $11\frac{1}{8}$	5 $0\frac{1}{8}$	15 $8\frac{7}{16}$	5 $3\frac{1}{8}$	16 6	5 $6\frac{1}{8}$	17 $3\frac{3}{8}$	5 $9\frac{1}{8}$	18 $0\frac{3}{4}$
4 $9\frac{1}{4}$	14 $11\frac{1}{2}$	5 $0\frac{1}{4}$	15 $8\frac{13}{16}$	5 $3\frac{1}{4}$	16 $6\frac{3}{8}$	5 $6\frac{1}{4}$	17 $3\frac{3}{4}$	5 $9\frac{1}{4}$	18 $1\frac{1}{8}$
4 $9\frac{3}{8}$	14 $11\frac{7}{8}$	5 $0\frac{3}{8}$	15 $9\frac{1}{4}$	5 $3\frac{3}{8}$	16 $6\frac{3}{4}$	5 $6\frac{3}{8}$	17 $4\frac{1}{8}$	5 $9\frac{3}{8}$	18 $1\frac{1}{2}$
4 $9\frac{1}{2}$	15 $0\frac{1}{4}$	5 $0\frac{1}{2}$	15 $9\frac{11}{16}$	5 $3\frac{1}{2}$	16 $7\frac{1}{8}$	5 $6\frac{1}{2}$	17 $4\frac{9}{16}$	5 $9\frac{1}{2}$	18 $1\frac{15}{16}$
4 $9\frac{5}{8}$	15 $0\frac{5}{8}$	5 $0\frac{5}{8}$	15 $10\frac{1}{8}$	5 $3\frac{5}{8}$	16 $7\frac{1}{2}$	5 $6\frac{5}{8}$	17 $4\frac{15}{16}$	5 $9\frac{5}{8}$	18 $2\frac{3}{8}$
4 $9\frac{3}{4}$	15 1	5 $0\frac{3}{4}$	15 $10\frac{1}{2}$	5 $3\frac{3}{4}$	16 $7\frac{7}{8}$	5 $6\frac{3}{4}$	17 $5\frac{5}{16}$	5 $9\frac{3}{4}$	18 $2\frac{3}{4}$
4 $9\frac{7}{8}$	15 $1\frac{7}{16}$	5 $0\frac{7}{8}$	15 $10\frac{7}{8}$	5 $3\frac{7}{8}$	16 $8\frac{1}{4}$	5 $6\frac{7}{8}$	17 $5\frac{11}{16}$	5 $9\frac{7}{8}$	18 $3\frac{1}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
5 10	18 $3\frac{9}{16}$	6 1	19 $0\frac{15}{16}$	6 4	19 $10\frac{3}{8}$	6 7	20 $7\frac{13}{16}$	6 10	21 $5\frac{3}{16}$
5 $10\frac{1}{8}$	18 $3\frac{15}{16}$	6 $1\frac{1}{8}$	19 $1\frac{5}{16}$	6 $4\frac{1}{8}$	19 $10\frac{3}{4}$	6 $7\frac{1}{8}$	20 $8\frac{1}{4}$	6 $10\frac{1}{8}$	21 $5\frac{5}{8}$
5 $10\frac{1}{4}$	18 $4\frac{3}{8}$	6 $1\frac{1}{4}$	19 $1\frac{3}{4}$	6 $4\frac{1}{4}$	19 $11\frac{1}{8}$	6 $7\frac{1}{4}$	20 $8\frac{5}{8}$	6 $10\frac{1}{4}$	21 6
5 $10\frac{3}{8}$	18 $4\frac{3}{4}$	6 $1\frac{3}{8}$	19 $2\frac{3}{16}$	6 $4\frac{3}{8}$	19 $11\frac{1}{2}$	6 $7\frac{3}{8}$	20 9	6 $10\frac{3}{8}$	21 $6\frac{3}{8}$
5 $10\frac{1}{2}$	18 $5\frac{1}{8}$	6 $1\frac{1}{2}$	19 $2\frac{9}{16}$	6 $4\frac{1}{2}$	19 $11\frac{15}{16}$	6 $7\frac{1}{2}$	20 $9\frac{3}{8}$	6 $10\frac{1}{2}$	21 $6\frac{3}{4}$
5 $10\frac{5}{8}$	18 $5\frac{1}{2}$	6 $1\frac{5}{8}$	19 $2\frac{15}{16}$	6 $4\frac{5}{8}$	20 $0\frac{3}{8}$	6 $7\frac{5}{8}$	20 $9\frac{3}{4}$	6 $10\frac{5}{8}$	21 $7\frac{3}{16}$
5 $10\frac{3}{4}$	18 6	6 $1\frac{3}{4}$	19 $3\frac{5}{16}$	6 $4\frac{3}{4}$	20 $0\frac{3}{4}$	6 $7\frac{3}{4}$	20 $10\frac{1}{8}$	6 $10\frac{3}{4}$	21 $7\frac{5}{8}$
5 $10\frac{7}{8}$	18 $6\frac{3}{8}$	6 $1\frac{7}{8}$	19 $3\frac{11}{16}$	6 $4\frac{7}{8}$	20 $1\frac{3}{16}$	6 $7\frac{7}{8}$	20 $10\frac{9}{16}$	6 $10\frac{7}{8}$	21 8
5 11	18 $6\frac{3}{4}$	6 2	19 $4\frac{1}{16}$	6 5	20 $1\frac{7}{16}$	6 8	20 $10\frac{15}{16}$	6 11	21 $8\frac{3}{8}$
5 $11\frac{1}{8}$	18 $7\frac{1}{8}$	6 $2\frac{1}{8}$	19 $4\frac{1}{2}$	6 $5\frac{1}{8}$	20 $1\frac{15}{16}$	6 $8\frac{1}{8}$	20 $11\frac{3}{8}$	6 $11\frac{1}{8}$	21 $8\frac{3}{4}$
5 $11\frac{1}{4}$	18 $7\frac{1}{2}$	6 $2\frac{1}{4}$	19 $4\frac{7}{8}$	6 $5\frac{1}{4}$	20 $2\frac{5}{16}$	6 $8\frac{1}{4}$	20 $11\frac{3}{4}$	6 $11\frac{1}{4}$	21 $9\frac{1}{8}$
5 $11\frac{3}{8}$	18 $7\frac{7}{8}$	6 $2\frac{3}{8}$	19 $5\frac{1}{4}$	6 $5\frac{3}{8}$	20 $2\frac{11}{16}$	6 $8\frac{3}{8}$	21 $0\frac{1}{8}$	6 $11\frac{3}{8}$	21 $9\frac{1}{2}$
5 $11\frac{1}{2}$	18 $8\frac{1}{4}$	6 $2\frac{1}{2}$	19 $5\frac{11}{16}$	6 $5\frac{1}{2}$	20 $3\frac{1}{16}$	6 $8\frac{1}{2}$	21 $0\frac{1}{2}$	6 $11\frac{1}{2}$	21 $9\frac{15}{16}$
5 $11\frac{5}{8}$	18 $8\frac{5}{8}$	6 $2\frac{5}{8}$	19 $6\frac{1}{8}$	6 $5\frac{5}{8}$	20 $3\frac{1}{2}$	6 $8\frac{5}{8}$	21 $0\frac{7}{8}$	6 $11\frac{5}{8}$	21 $10\frac{3}{8}$
5 $11\frac{3}{4}$	18 9	6 $2\frac{3}{4}$	19 $6\frac{1}{2}$	6 $5\frac{3}{4}$	20 $3\frac{7}{8}$	6 $8\frac{3}{4}$	21 $1\frac{1}{4}$	6 $11\frac{3}{4}$	21 $10\frac{3}{4}$
5 $11\frac{7}{8}$	18 $9\frac{3}{8}$	6 $2\frac{7}{8}$	19 $6\frac{7}{8}$	6 $5\frac{7}{8}$	20 $4\frac{1}{4}$	6 $8\frac{7}{8}$	21 $1\frac{5}{8}$	6 $11\frac{7}{8}$	21 $11\frac{1}{8}$
6 0	18 $9\frac{13}{16}$	6 3	19 $7\frac{1}{8}$	6 6	20 $4\frac{11}{16}$	6 9	21 $2\frac{1}{16}$	7 0	21 $11\frac{1}{2}$
6 $0\frac{1}{8}$	18 $10\frac{1}{4}$	6 $3\frac{1}{8}$	19 $7\frac{5}{8}$	6 $6\frac{1}{8}$	20 $5\frac{1}{16}$	6 $9\frac{1}{8}$	21 $2\frac{7}{16}$	7 $0\frac{1}{8}$	21 $11\frac{7}{8}$
6 $0\frac{1}{4}$	18 $10\frac{5}{8}$	6 $3\frac{1}{4}$	19 8	6 $6\frac{1}{4}$	20 $5\frac{7}{16}$	6 $9\frac{1}{4}$	21 $2\frac{7}{8}$	7 $0\frac{1}{4}$	22 $0\frac{1}{4}$
6 $0\frac{3}{8}$	18 11	6 $3\frac{3}{8}$	19 $8\frac{3}{8}$	6 $6\frac{3}{8}$	20 $5\frac{13}{16}$	6 $9\frac{3}{8}$	21 $3\frac{1}{4}$	7 $0\frac{3}{8}$	22 $0\frac{5}{8}$
6 $0\frac{1}{2}$	18 $11\frac{3}{8}$	6 $3\frac{1}{2}$	19 $8\frac{13}{16}$	6 $6\frac{1}{2}$	20 $6\frac{3}{16}$	6 $9\frac{1}{2}$	21 $3\frac{11}{16}$	7 $0\frac{1}{2}$	22 $1\frac{1}{16}$
6 $0\frac{5}{8}$	18 $11\frac{13}{16}$	6 $3\frac{5}{8}$	19 $9\frac{1}{4}$	6 $6\frac{5}{8}$	20 $6\frac{5}{8}$	6 $9\frac{5}{8}$	21 $4\frac{1}{16}$	7 $0\frac{5}{8}$	22 $1\frac{1}{2}$
6 $0\frac{3}{4}$	19 $0\frac{3}{16}$	6 $3\frac{3}{4}$	19 $9\frac{5}{8}$	6 $6\frac{3}{4}$	20 7	6 $9\frac{3}{4}$	21 $4\frac{7}{16}$	7 $0\frac{3}{4}$	22 $1\frac{7}{8}$
6 $0\frac{7}{8}$	19 $0\frac{9}{16}$	6 $3\frac{7}{8}$	19 10	6 $6\frac{7}{8}$	20 $7\frac{3}{8}$	6 $9\frac{7}{8}$	21 $4\frac{13}{16}$	7 $0\frac{7}{8}$	22 $2\frac{1}{4}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	1	22	$2\frac{11}{16}$	7	4	23	$0\frac{1}{16}$	7	7	23	$9\frac{1}{2}$	7	10	24	$6\frac{15}{16}$
7	$1\frac{1}{8}$	22	$3\frac{1}{16}$	7	$4\frac{1}{8}$	23	$0\frac{1}{2}$	7	$7\frac{1}{8}$	23	$9\frac{7}{8}$	7	$10\frac{1}{8}$	24	$7\frac{3}{8}$
7	$1\frac{1}{4}$	22	$3\frac{7}{16}$	7	$4\frac{1}{4}$	23	$0\frac{7}{8}$	7	$7\frac{1}{4}$	23	$10\frac{1}{4}$	7	$10\frac{1}{4}$	24	$7\frac{3}{4}$
7	$1\frac{3}{8}$	22	$3\frac{13}{16}$	7	$4\frac{3}{8}$	23	$1\frac{1}{4}$	7	$7\frac{3}{8}$	23	$10\frac{11}{16}$	7	$10\frac{3}{8}$	24	$8\frac{1}{8}$
7	$1\frac{1}{2}$	22	$4\frac{3}{16}$	7	$4\frac{1}{2}$	23	$1\frac{11}{16}$	7	$7\frac{1}{2}$	23	$11\frac{1}{16}$	7	$10\frac{1}{2}$	24	$8\frac{1}{2}$
7	$1\frac{5}{8}$	22	$4\frac{9}{8}$	7	$4\frac{5}{8}$	23	$2\frac{1}{16}$	7	$7\frac{5}{8}$	23	$11\frac{1}{2}$	7	$10\frac{5}{8}$	24	$8\frac{7}{8}$
7	$1\frac{3}{4}$	22	5	7	$4\frac{3}{4}$	23	$2\frac{7}{16}$	7	$7\frac{3}{4}$	23	$11\frac{7}{8}$	7	$10\frac{3}{4}$	24	$9\frac{1}{4}$
7	$1\frac{7}{8}$	22	$5\frac{3}{8}$	7	$4\frac{7}{8}$	23	$2\frac{13}{16}$	7	$7\frac{7}{8}$	24	$0\frac{1}{4}$	7	$10\frac{7}{8}$	24	$9\frac{5}{8}$
7	2	22	$5\frac{3}{4}$	7	5	23	$3\frac{3}{16}$	7	8	24	$0\frac{5}{8}$	7	11	24	$10\frac{1}{16}$
7	$2\frac{1}{8}$	22	$6\frac{3}{16}$	7	$5\frac{1}{8}$	23	$3\frac{9}{16}$	7	$8\frac{1}{8}$	24	1	7	$11\frac{1}{8}$	24	$10\frac{1}{2}$
7	$2\frac{1}{4}$	22	$6\frac{9}{16}$	7	$5\frac{1}{4}$	23	$3\frac{7}{8}$	7	$8\frac{1}{4}$	24	$1\frac{3}{8}$	7	$11\frac{1}{4}$	24	$10\frac{7}{8}$
7	$2\frac{3}{8}$	22	7	7	$5\frac{3}{8}$	23	$4\frac{1}{4}$	7	$8\frac{3}{8}$	24	$1\frac{13}{16}$	7	$11\frac{3}{8}$	24	$11\frac{1}{4}$
7	$2\frac{1}{2}$	22	$7\frac{3}{8}$	7	$5\frac{1}{2}$	23	$4\frac{3}{4}$	7	$8\frac{1}{2}$	24	$2\frac{3}{16}$	7	$11\frac{1}{2}$	24	$11\frac{5}{8}$
7	$2\frac{3}{8}$	22	$7\frac{13}{16}$	7	$5\frac{5}{8}$	23	$5\frac{3}{16}$	7	$8\frac{5}{8}$	24	$2\frac{5}{8}$	7	$11\frac{5}{8}$	25	0
7	$2\frac{3}{4}$	22	$8\frac{3}{16}$	7	$5\frac{3}{4}$	23	$5\frac{5}{8}$	7	$8\frac{3}{4}$	24	3	7	$11\frac{3}{4}$	25	$0\frac{3}{8}$
7	$2\frac{7}{8}$	22	$8\frac{9}{16}$	7	$5\frac{7}{8}$	23	6	7	$8\frac{7}{8}$	24	$3\frac{3}{8}$	7	$11\frac{7}{8}$	25	$0\frac{13}{16}$
7	3	22	$8\frac{15}{16}$	7	6	23	$6\frac{3}{8}$	7	9	24	$3\frac{13}{16}$	8	0	25	$1\frac{1}{16}$
7	$3\frac{1}{8}$	22	$9\frac{1}{4}$	7	$6\frac{1}{8}$	23	$6\frac{3}{4}$	7	$9\frac{1}{8}$	24	$4\frac{3}{16}$	8	$0\frac{1}{2}$	25	$2\frac{13}{16}$
7	$3\frac{1}{4}$	22	$9\frac{5}{8}$	7	$6\frac{1}{4}$	23	$7\frac{1}{8}$	7	$9\frac{1}{4}$	24	$4\frac{9}{16}$	8	1	25	$4\frac{5}{16}$
7	$3\frac{3}{8}$	22	$10\frac{1}{16}$	7	$6\frac{3}{8}$	23	$7\frac{9}{16}$	7	$9\frac{3}{8}$	24	$4\frac{15}{16}$	8	$1\frac{1}{2}$	25	$5\frac{13}{16}$
7	$3\frac{1}{2}$	22	$10\frac{1}{2}$	7	$6\frac{1}{2}$	23	$7\frac{15}{16}$	7	$9\frac{1}{2}$	24	$5\frac{5}{16}$	8	2	25	$7\frac{1}{2}$
7	$3\frac{5}{8}$	22	$10\frac{7}{8}$	7	$6\frac{5}{8}$	23	$8\frac{3}{8}$	7	$9\frac{5}{8}$	24	$5\frac{5}{8}$				
7	$3\frac{3}{4}$	22	$11\frac{1}{4}$	7	$6\frac{3}{4}$	23	$8\frac{3}{4}$	7	$9\frac{3}{4}$	24	$6\frac{1}{16}$				
7	$3\frac{7}{8}$	22	$11\frac{5}{8}$	7	$6\frac{7}{8}$	23	$9\frac{1}{8}$	7	$9\frac{7}{8}$	24	$6\frac{1}{2}$				

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
0	10	2	$6\frac{7}{8}$	1	1	3	$4\frac{3}{16}$	1	4	4	$1\frac{11}{16}$	1	7	4	$11\frac{3}{16}$	1	10	5	$8\frac{11}{16}$
0	$10\frac{1}{8}$	2	$7\frac{1}{4}$	1	$1\frac{1}{8}$	3	$4\frac{9}{16}$	1	$4\frac{1}{8}$	4	$2\frac{1}{8}$	1	$7\frac{1}{8}$	4	$11\frac{1}{2}$	1	$10\frac{1}{8}$	5	$9\frac{1}{16}$
0	$10\frac{1}{4}$	2	$7\frac{5}{8}$	1	$1\frac{1}{4}$	3	$5\frac{1}{16}$	1	$4\frac{1}{4}$	4	$2\frac{1}{2}$	1	$7\frac{1}{4}$	4	$11\frac{15}{16}$	1	$10\frac{1}{4}$	5	$9\frac{9}{16}$
0	$10\frac{3}{8}$	2	$8\frac{1}{16}$	1	$1\frac{3}{8}$	3	$5\frac{7}{16}$	1	$4\frac{3}{8}$	4	$2\frac{13}{16}$	1	$7\frac{3}{8}$	5	$0\frac{1}{4}$	1	$10\frac{3}{8}$	5	$9\frac{7}{8}$
0	$10\frac{1}{2}$	2	$8\frac{7}{16}$	1	$1\frac{1}{2}$	3	$5\frac{13}{16}$	1	$4\frac{1}{2}$	4	$3\frac{5}{16}$	1	$7\frac{1}{2}$	5	$0\frac{11}{16}$	1	$10\frac{1}{2}$	5	$10\frac{5}{16}$
0	$10\frac{5}{8}$	2	$8\frac{13}{16}$	1	$1\frac{5}{8}$	3	$6\frac{3}{16}$	1	$4\frac{5}{8}$	4	$3\frac{9}{16}$	1	$7\frac{5}{8}$	5	$1\frac{1}{16}$	1	$10\frac{5}{8}$	5	$10\frac{5}{8}$
0	$10\frac{3}{4}$	2	$9\frac{3}{16}$	1	$1\frac{3}{4}$	3	$6\frac{9}{16}$	1	$4\frac{3}{4}$	4	$3\frac{15}{16}$	1	$7\frac{3}{4}$	5	$1\frac{7}{16}$	1	$10\frac{3}{4}$	5	$11\frac{1}{16}$
0	$10\frac{7}{8}$	2	$9\frac{9}{16}$	1	$1\frac{7}{8}$	3	$6\frac{15}{16}$	1	$4\frac{7}{8}$	4	$4\frac{5}{16}$	1	$7\frac{7}{8}$	5	$1\frac{7}{8}$	1	$10\frac{7}{8}$	5	$11\frac{7}{16}$
0	11	2	$9\frac{15}{16}$	1	2	3	$7\frac{3}{8}$	1	5	4	$4\frac{3}{4}$	1	8	5	$2\frac{5}{16}$	1	11	5	$11\frac{7}{8}$
0	$11\frac{1}{8}$	2	$10\frac{5}{16}$	1	$2\frac{1}{8}$	3	$7\frac{11}{16}$	1	$5\frac{1}{8}$	4	$5\frac{3}{16}$	1	$8\frac{1}{8}$	5	$2\frac{9}{16}$	1	$11\frac{1}{8}$	6	$0\frac{5}{16}$
0	$11\frac{1}{4}$	2	$10\frac{13}{16}$	1	$2\frac{1}{4}$	3	$8\frac{3}{16}$	1	$5\frac{1}{4}$	4	$5\frac{11}{16}$	1	$8\frac{1}{4}$	5	$3\frac{1}{16}$	1	$11\frac{1}{4}$	6	$0\frac{11}{16}$
0	$11\frac{3}{8}$	2	$11\frac{3}{16}$	1	$2\frac{3}{8}$	3	$8\frac{9}{16}$	1	$5\frac{3}{8}$	4	$5\frac{15}{16}$	1	$8\frac{3}{8}$	5	$3\frac{3}{8}$	1	$11\frac{3}{8}$	6	$1\frac{1}{16}$
0	$11\frac{1}{2}$	2	$11\frac{9}{16}$	1	$2\frac{1}{2}$	3	$8\frac{15}{16}$	1	$5\frac{1}{2}$	4	$6\frac{7}{16}$	1	$8\frac{1}{2}$	5	$3\frac{13}{16}$	1	$11\frac{1}{2}$	6	$1\frac{3}{8}$
0	$11\frac{5}{8}$	2	$11\frac{15}{16}$	1	$2\frac{5}{8}$	3	$9\frac{7}{16}$	1	$5\frac{5}{8}$	4	$6\frac{3}{4}$	1	$8\frac{5}{8}$	5	$4\frac{3}{16}$	1	$11\frac{5}{8}$	6	$1\frac{3}{4}$
0	$11\frac{3}{4}$	3	$0\frac{3}{8}$	1	$2\frac{3}{4}$	3	$9\frac{3}{4}$	1	$5\frac{3}{4}$	4	$7\frac{3}{16}$	1	$8\frac{3}{4}$	5	$4\frac{5}{8}$	1	$11\frac{3}{4}$	6	$2\frac{3}{16}$
0	$11\frac{7}{8}$	3	$0\frac{3}{4}$	1	$2\frac{7}{8}$	3	$10\frac{3}{16}$	1	$5\frac{7}{8}$	4	$7\frac{9}{16}$	1	$8\frac{7}{8}$	5	$4\frac{15}{16}$	1	$11\frac{7}{8}$	6	$2\frac{9}{16}$
1	0	3	$1\frac{1}{8}$	1	3	3	$10\frac{9}{16}$	1	6	4	$7\frac{15}{16}$	1	9	5	$5\frac{7}{16}$	2	0	6	3
1	$0\frac{1}{8}$	3	$1\frac{7}{16}$	1	$3\frac{1}{8}$	3	$10\frac{15}{16}$	1	$6\frac{1}{8}$	4	$8\frac{5}{16}$	1	$9\frac{1}{8}$	5	$5\frac{3}{4}$	2	$0\frac{1}{8}$	6	$3\frac{3}{8}$
1	$0\frac{1}{4}$	3	$1\frac{13}{16}$	1	$3\frac{1}{4}$	3	$11\frac{5}{16}$	1	$6\frac{1}{4}$	4	$8\frac{11}{16}$	1	$9\frac{1}{4}$	5	$6\frac{3}{16}$	2	$0\frac{1}{4}$	6	$3\frac{13}{16}$
1	$0\frac{3}{8}$	3	$2\frac{5}{16}$	1	$3\frac{3}{8}$	3	$11\frac{3}{4}$	1	$6\frac{3}{8}$	4	$9\frac{1}{16}$	1	$9\frac{3}{8}$	5	$6\frac{9}{16}$	2	$0\frac{3}{8}$	6	$4\frac{1}{8}$
1	$0\frac{1}{2}$	3	$2\frac{11}{16}$	1	$3\frac{1}{2}$	4	$0\frac{3}{16}$	1	$6\frac{1}{2}$	4	$9\frac{1}{2}$	1	$9\frac{1}{2}$	5	$6\frac{15}{16}$	2	$0\frac{1}{2}$	6	$4\frac{9}{16}$
1	$0\frac{5}{8}$	3	$3\frac{1}{16}$	1	$3\frac{5}{8}$	4	$0\frac{7}{16}$	1	$6\frac{5}{8}$	4	$9\frac{15}{16}$	1	$9\frac{5}{8}$	5	$7\frac{5}{16}$	2	$0\frac{5}{8}$	6	$4\frac{15}{16}$
1	$0\frac{3}{4}$	3	$3\frac{7}{16}$	1	$3\frac{3}{4}$	4	$0\frac{3}{4}$	1	$6\frac{3}{4}$	4	$10\frac{5}{16}$	1	$9\frac{3}{4}$	5	$7\frac{3}{4}$	2	$0\frac{3}{4}$	6	$5\frac{5}{16}$
1	$0\frac{7}{8}$	3	$3\frac{13}{16}$	1	$3\frac{7}{8}$	4	$1\frac{3}{16}$	1	$6\frac{7}{8}$	4	$10\frac{11}{16}$	1	$9\frac{7}{8}$	5	$8\frac{3}{16}$	2	$0\frac{7}{8}$	6	$5\frac{9}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 $5\frac{15}{16}$	2 4	7 $3\frac{5}{16}$	2 7	8 $0\frac{13}{16}$	2 10	8 $10\frac{1}{4}$	3 1	9 $7\frac{11}{16}$
2 $1\frac{1}{8}$	6 $6\frac{5}{16}$	2 $4\frac{1}{8}$	7 $3\frac{11}{16}$	2 $7\frac{1}{8}$	8 $1\frac{3}{16}$	2 $10\frac{1}{8}$	8 $10\frac{11}{16}$	3 $1\frac{1}{8}$	9 $8\frac{1}{16}$
2 $1\frac{1}{4}$	6 $6\frac{13}{16}$	2 $4\frac{1}{4}$	7 $4\frac{1}{16}$	2 $7\frac{1}{4}$	8 $1\frac{9}{16}$	2 $10\frac{1}{4}$	8 11	3 $1\frac{1}{4}$	9 $8\frac{7}{16}$
2 $1\frac{3}{8}$	6 $7\frac{1}{16}$	2 $4\frac{3}{8}$	7 $4\frac{1}{2}$	2 $7\frac{3}{8}$	8 $1\frac{15}{16}$	2 $10\frac{3}{8}$	8 $11\frac{3}{8}$	3 $1\frac{3}{8}$	9 $8\frac{13}{16}$
2 $1\frac{1}{2}$	6 $7\frac{7}{16}$	2 $4\frac{1}{2}$	7 $4\frac{15}{16}$	2 $7\frac{1}{2}$	8 $2\frac{5}{16}$	2 $10\frac{1}{2}$	8 $11\frac{13}{16}$	3 $1\frac{1}{2}$	9 $9\frac{1}{4}$
2 $1\frac{5}{8}$	6 $7\frac{7}{8}$	2 $4\frac{5}{8}$	7 $5\frac{5}{16}$	2 $7\frac{5}{8}$	8 $2\frac{11}{16}$	2 $10\frac{5}{8}$	9 $0\frac{3}{16}$	3 $1\frac{5}{8}$	9 $9\frac{5}{8}$
2 $1\frac{3}{4}$	6 $8\frac{5}{16}$	2 $4\frac{3}{4}$	7 $5\frac{11}{16}$	2 $7\frac{3}{4}$	8 $3\frac{1}{8}$	2 $10\frac{3}{4}$	9 $0\frac{9}{16}$	3 $1\frac{3}{4}$	9 10
2 $1\frac{7}{8}$	6 $8\frac{11}{16}$	2 $4\frac{7}{8}$	7 $6\frac{1}{16}$	2 $7\frac{7}{8}$	8 $3\frac{1}{2}$	2 $10\frac{7}{8}$	9 $0\frac{15}{16}$	3 $1\frac{7}{8}$	9 $10\frac{3}{8}$
2 2	6 $9\frac{1}{8}$	2 5	7 $6\frac{7}{16}$	2 8	8 $3\frac{15}{16}$	2 11	9 $1\frac{3}{8}$	3 2	9 $10\frac{7}{8}$
2 $2\frac{1}{8}$	6 $9\frac{1}{2}$	2 $5\frac{1}{8}$	7 $6\frac{13}{16}$	2 $8\frac{1}{8}$	8 $4\frac{5}{16}$	2 $11\frac{1}{8}$	9 $1\frac{11}{16}$	3 $2\frac{1}{8}$	9 $11\frac{1}{4}$
2 $2\frac{1}{4}$	6 $9\frac{13}{16}$	2 $5\frac{1}{4}$	7 $7\frac{3}{16}$	2 $8\frac{1}{4}$	8 $4\frac{11}{16}$	2 $11\frac{1}{4}$	9 $2\frac{1}{8}$	3 $2\frac{1}{4}$	9 $11\frac{9}{16}$
2 $2\frac{3}{8}$	6 $10\frac{1}{4}$	2 $5\frac{3}{8}$	7 $7\frac{9}{16}$	2 $8\frac{3}{8}$	8 $5\frac{1}{16}$	2 $11\frac{3}{8}$	9 $2\frac{9}{16}$	3 $2\frac{3}{8}$	9 $11\frac{15}{16}$
2 $2\frac{1}{2}$	6 $10\frac{11}{16}$	2 $5\frac{1}{2}$	7 $8\frac{1}{16}$	2 $8\frac{1}{2}$	8 $5\frac{1}{2}$	2 $11\frac{1}{2}$	9 $2\frac{15}{16}$	3 $2\frac{1}{2}$	10 $0\frac{1}{4}$
2 $2\frac{5}{8}$	6 $11\frac{1}{16}$	2 $5\frac{5}{8}$	7 $8\frac{7}{16}$	2 $8\frac{5}{8}$	8 $5\frac{13}{16}$	2 $11\frac{5}{8}$	9 $3\frac{5}{16}$	3 $2\frac{5}{8}$	10 $0\frac{11}{16}$
2 $2\frac{3}{4}$	6 $11\frac{1}{2}$	2 $5\frac{3}{4}$	7 $8\frac{13}{16}$	2 $8\frac{3}{4}$	8 $6\frac{3}{16}$	2 $11\frac{3}{4}$	9 $3\frac{11}{16}$	3 $2\frac{3}{4}$	10 $1\frac{1}{16}$
2 $2\frac{7}{8}$	6 $11\frac{13}{16}$	2 $5\frac{7}{8}$	7 $9\frac{3}{16}$	2 $8\frac{7}{8}$	8 $6\frac{9}{16}$	2 $11\frac{7}{8}$	9 $4\frac{1}{16}$	3 $2\frac{7}{8}$	10 $1\frac{1}{2}$
2 3	7 $0\frac{5}{16}$	2 6	7 $9\frac{5}{8}$	2 9	8 7	3 0	9 $4\frac{1}{2}$	3 3	10 $1\frac{15}{16}$
2 $3\frac{1}{8}$	7 $0\frac{9}{16}$	2 $6\frac{1}{8}$	7 $10\frac{1}{16}$	2 $9\frac{1}{8}$	8 $7\frac{7}{16}$	3 $0\frac{1}{8}$	9 $4\frac{7}{8}$	3 $3\frac{1}{8}$	10 $2\frac{5}{16}$
2 $3\frac{1}{4}$	7 $0\frac{15}{16}$	2 $6\frac{1}{4}$	7 $10\frac{7}{16}$	2 $9\frac{1}{4}$	8 $7\frac{7}{8}$	3 $0\frac{1}{4}$	9 $5\frac{5}{16}$	3 $3\frac{1}{4}$	10 $2\frac{3}{4}$
2 $3\frac{3}{8}$	7 $1\frac{3}{8}$	2 $6\frac{3}{8}$	7 $10\frac{13}{16}$	2 $9\frac{3}{8}$	8 $8\frac{3}{16}$	3 $0\frac{3}{8}$	9 $5\frac{9}{16}$	3 $3\frac{3}{8}$	10 3
2 $3\frac{1}{2}$	7 $1\frac{13}{16}$	2 $6\frac{1}{2}$	7 $11\frac{1}{4}$	2 $9\frac{1}{2}$	8 $8\frac{5}{8}$	3 $0\frac{1}{2}$	9 $6\frac{1}{8}$	3 $3\frac{1}{2}$	10 $3\frac{3}{8}$
2 $3\frac{5}{8}$	7 $2\frac{3}{16}$	2 $6\frac{5}{8}$	7 $11\frac{5}{8}$	2 $9\frac{5}{8}$	8 9	3 $0\frac{5}{8}$	9 $6\frac{1}{2}$	3 $3\frac{5}{8}$	10 $3\frac{7}{8}$
2 $3\frac{3}{4}$	7 $2\frac{9}{16}$	2 $6\frac{3}{4}$	8 0	2 $9\frac{3}{4}$	8 $9\frac{7}{16}$	3 $0\frac{3}{4}$	9 $6\frac{7}{8}$	3 $3\frac{3}{4}$	10 $4\frac{5}{16}$
2 $3\frac{7}{8}$	7 $2\frac{15}{16}$	2 $6\frac{7}{8}$	8 $0\frac{3}{8}$	2 $9\frac{7}{8}$	8 $9\frac{7}{8}$	3 $0\frac{7}{8}$	9 $7\frac{5}{16}$	3 $3\frac{7}{8}$	10 $4\frac{11}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in	ft. in.	ft. in.
3 4	10 $5\frac{1}{8}$	3 7	11 $2\frac{1}{2}$	3 10	11 $11\frac{15}{16}$	4 1	12 $9\frac{3}{8}$	4 4	13 $6\frac{3}{4}$
3 $4\frac{1}{8}$	10 $5\frac{7}{16}$	3 $7\frac{1}{8}$	11 $2\frac{15}{16}$	3 $10\frac{1}{8}$	12 $0\frac{5}{16}$	4 $1\frac{1}{8}$	12 $9\frac{13}{16}$	4 $4\frac{1}{8}$	13 $7\frac{1}{16}$
3 $4\frac{1}{4}$	10 $5\frac{7}{8}$	3 $7\frac{1}{4}$	11 $3\frac{5}{16}$	3 $10\frac{1}{4}$	12 $0\frac{11}{16}$	4 $1\frac{1}{4}$	12 $10\frac{3}{16}$	4 $4\frac{1}{4}$	13 $7\frac{1}{2}$
3 $4\frac{3}{8}$	10 $6\frac{5}{16}$	3 $7\frac{3}{8}$	11 $3\frac{11}{16}$	3 $10\frac{3}{8}$	12 $1\frac{1}{16}$	4 $1\frac{3}{8}$	12 $10\frac{9}{16}$	4 $4\frac{3}{8}$	13 $7\frac{15}{16}$
3 $4\frac{1}{2}$	10 $6\frac{11}{16}$	3 $7\frac{1}{2}$	11 $4\frac{1}{16}$	3 $10\frac{1}{2}$	12 $1\frac{7}{16}$	4 $1\frac{1}{2}$	12 11	4 $4\frac{1}{2}$	13 $8\frac{5}{16}$
3 $4\frac{5}{8}$	10 $7\frac{1}{16}$	3 $7\frac{5}{8}$	11 $4\frac{7}{16}$	3 $10\frac{5}{8}$	12 $1\frac{13}{16}$	4 $1\frac{5}{8}$	12 $11\frac{3}{8}$	4 $4\frac{5}{8}$	13 $8\frac{3}{4}$
3 $4\frac{3}{4}$	10 $7\frac{7}{16}$	3 $7\frac{3}{4}$	11 $4\frac{13}{16}$	3 $10\frac{3}{4}$	12 $2\frac{3}{16}$	4 $1\frac{3}{4}$	12 $11\frac{11}{16}$	4 $4\frac{3}{4}$	13 $9\frac{1}{16}$
3 $4\frac{7}{8}$	10 $7\frac{15}{16}$	3 $7\frac{7}{8}$	11 $5\frac{3}{16}$	3 $10\frac{7}{8}$	12 $2\frac{5}{8}$	4 $1\frac{7}{8}$	13 $0\frac{1}{16}$	4 $4\frac{7}{8}$	13 $9\frac{1}{2}$
3 5	10 $8\frac{3}{16}$	3 8	11 $5\frac{5}{8}$	3 11	12 $3\frac{1}{16}$	4 2	13 $0\frac{1}{2}$	4 5	13 $9\frac{15}{16}$
3 $5\frac{1}{8}$	10 $8\frac{9}{16}$	3 $8\frac{1}{8}$	11 $6\frac{1}{16}$	3 $11\frac{1}{8}$	12 $3\frac{7}{16}$	4 $2\frac{1}{8}$	13 $0\frac{15}{16}$	4 $5\frac{1}{8}$	13 $10\frac{5}{16}$
3 $5\frac{1}{4}$	10 $8\frac{15}{16}$	3 $8\frac{1}{4}$	11 $6\frac{7}{16}$	3 $11\frac{1}{4}$	12 $3\frac{13}{16}$	4 $2\frac{1}{4}$	13 $1\frac{5}{16}$	4 $5\frac{1}{4}$	13 $10\frac{11}{16}$
3 $5\frac{3}{8}$	10 $9\frac{5}{16}$	3 $8\frac{3}{8}$	11 $6\frac{13}{16}$	3 $11\frac{3}{8}$	12 $4\frac{3}{16}$	4 $2\frac{3}{8}$	13 $1\frac{11}{16}$	4 $5\frac{3}{8}$	13 $11\frac{1}{16}$
3 $5\frac{1}{2}$	10 $9\frac{11}{16}$	3 $8\frac{1}{2}$	11 $7\frac{3}{16}$	3 $11\frac{1}{2}$	12 $4\frac{9}{16}$	4 $2\frac{1}{2}$	13 $2\frac{1}{16}$	4 $5\frac{1}{2}$	13 $11\frac{7}{16}$
3 $5\frac{5}{8}$	10 $10\frac{1}{16}$	3 $8\frac{5}{8}$	11 $7\frac{9}{16}$	3 $11\frac{5}{8}$	12 $4\frac{15}{16}$	4 $2\frac{5}{8}$	13 $2\frac{7}{16}$	4 $5\frac{5}{8}$	13 $11\frac{13}{16}$
3 $5\frac{3}{4}$	10 $10\frac{1}{2}$	3 $8\frac{3}{4}$	11 $7\frac{15}{16}$	3 $11\frac{3}{4}$	12 $5\frac{3}{8}$	4 $2\frac{3}{4}$	13 $2\frac{13}{16}$	4 $5\frac{3}{4}$	14 $0\frac{1}{4}$
3 $5\frac{7}{8}$	10 $10\frac{15}{16}$	3 $8\frac{7}{8}$	11 $8\frac{3}{8}$	3 $11\frac{7}{8}$	12 $5\frac{13}{16}$	4 $2\frac{7}{8}$	13 $3\frac{3}{16}$	4 $5\frac{7}{8}$	14 $0\frac{11}{16}$
3 6	10 $11\frac{3}{8}$	3 9	11 $8\frac{13}{16}$	4 0	12 $6\frac{1}{4}$	4 3	13 $3\frac{5}{8}$	4 6	14 $1\frac{1}{8}$
3 $6\frac{1}{8}$	10 $11\frac{13}{16}$	3 $9\frac{1}{8}$	11 $9\frac{3}{16}$	4 $0\frac{1}{8}$	12 $6\frac{5}{8}$	4 $3\frac{1}{8}$	13 $4\frac{1}{16}$	4 $6\frac{1}{8}$	14 $1\frac{1}{2}$
3 $6\frac{1}{4}$	11 $0\frac{3}{16}$	3 $9\frac{1}{4}$	11 $9\frac{9}{16}$	4 $0\frac{1}{4}$	12 7	4 $3\frac{1}{4}$	13 $4\frac{7}{16}$	4 $6\frac{1}{4}$	14 $1\frac{15}{16}$
3 $6\frac{3}{8}$	11 $0\frac{9}{16}$	3 $9\frac{3}{8}$	11 $9\frac{3}{4}$	4 $0\frac{3}{8}$	12 $7\frac{3}{8}$	4 $3\frac{3}{8}$	13 $4\frac{13}{16}$	4 $6\frac{3}{8}$	14 $2\frac{5}{16}$
3 $6\frac{1}{2}$	11 $0\frac{15}{16}$	3 $9\frac{1}{2}$	11 $10\frac{3}{16}$	4 $0\frac{1}{2}$	12 $7\frac{11}{16}$	4 $3\frac{1}{2}$	13 $5\frac{3}{16}$	4 $6\frac{1}{2}$	14 $2\frac{11}{16}$
3 $6\frac{5}{8}$	11 $1\frac{5}{16}$	3 $9\frac{5}{8}$	11 $10\frac{9}{16}$	4 $0\frac{5}{8}$	12 $8\frac{1}{16}$	4 $3\frac{5}{8}$	13 $5\frac{9}{16}$	4 $6\frac{5}{8}$	14 $3\frac{1}{16}$
3 $6\frac{3}{4}$	11 $1\frac{3}{4}$	3 $9\frac{3}{4}$	11 11	4 $0\frac{3}{4}$	12 $8\frac{1}{2}$	4 $3\frac{3}{4}$	13 $5\frac{15}{16}$	4 $6\frac{3}{4}$	14 $3\frac{7}{16}$
3 $6\frac{7}{8}$	11 $2\frac{1}{8}$	3 $9\frac{7}{8}$	11 $11\frac{7}{16}$	4 $0\frac{7}{8}$	12 $8\frac{15}{16}$	4 $3\frac{7}{8}$	13 $6\frac{5}{16}$	4 $6\frac{7}{8}$	14 $3\frac{13}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
4 7	14 $4\frac{3}{16}$	4 10	15 $1\frac{5}{8}$	5 1	15 $11\frac{1}{16}$	5 4	16 $8\frac{1}{2}$	5 7	17 $5\frac{7}{8}$
4 $7\frac{1}{8}$	14 $4\frac{5}{8}$	4 $10\frac{1}{8}$	15 2	5 $1\frac{1}{8}$	15 $11\frac{7}{16}$	5 $4\frac{1}{8}$	16 $8\frac{15}{16}$	5 $7\frac{1}{8}$	17 $6\frac{1}{4}$
4 $7\frac{1}{4}$	14 $5\frac{1}{16}$	4 $10\frac{1}{4}$	15 $2\frac{7}{16}$	5 $1\frac{1}{4}$	15 $11\frac{13}{16}$	5 $4\frac{1}{4}$	16 $9\frac{5}{16}$	5 $7\frac{1}{4}$	17 $6\frac{11}{16}$
4 $7\frac{3}{8}$	14 $5\frac{7}{16}$	4 $10\frac{3}{8}$	15 $2\frac{13}{16}$	5 $1\frac{3}{8}$	16 $0\frac{3}{16}$	5 $4\frac{3}{8}$	16 $9\frac{11}{16}$	5 $7\frac{3}{8}$	17 $7\frac{1}{16}$
4 $7\frac{1}{2}$	14 $5\frac{13}{16}$	4 $10\frac{1}{2}$	15 $3\frac{3}{16}$	5 $1\frac{1}{2}$	16 $0\frac{5}{8}$	5 $4\frac{1}{2}$	16 $10\frac{1}{16}$	5 $7\frac{1}{2}$	17 $7\frac{1}{2}$
4 $7\frac{5}{8}$	14 $6\frac{3}{16}$	4 $10\frac{5}{8}$	15 $3\frac{5}{8}$	5 $1\frac{5}{8}$	16 1	5 $4\frac{5}{8}$	16 $10\frac{7}{16}$	5 $7\frac{5}{8}$	17 $7\frac{15}{16}$
4 $7\frac{3}{4}$	14 $6\frac{9}{16}$	4 $10\frac{3}{4}$	15 4	5 $1\frac{3}{4}$	16 $1\frac{7}{16}$	5 $4\frac{3}{4}$	16 $10\frac{13}{16}$	5 $7\frac{3}{4}$	17 $8\frac{5}{16}$
4 $7\frac{7}{8}$	14 7	4 $10\frac{7}{8}$	15 $4\frac{3}{8}$	5 $1\frac{7}{8}$	16 $1\frac{13}{16}$	5 $4\frac{7}{8}$	16 $11\frac{3}{16}$	5 $7\frac{7}{8}$	17 $8\frac{11}{16}$
4 8	14 $7\frac{3}{8}$	4 11	15 $4\frac{3}{4}$	5 2	16 $2\frac{3}{16}$	5 5	16 $11\frac{5}{8}$	5 8	17 $9\frac{1}{16}$
4 $8\frac{1}{8}$	14 $7\frac{13}{16}$	4 $11\frac{1}{8}$	15 $5\frac{1}{8}$	5 $2\frac{1}{8}$	16 $2\frac{5}{8}$	5 $5\frac{1}{8}$	17 $0\frac{1}{16}$	5 $8\frac{1}{8}$	17 $9\frac{7}{16}$
4 $8\frac{1}{4}$	14 $8\frac{1}{16}$	4 $11\frac{1}{4}$	15 $5\frac{1}{2}$	5 $2\frac{1}{4}$	16 $3\frac{1}{16}$	5 $5\frac{1}{4}$	17 $0\frac{7}{16}$	5 $8\frac{1}{4}$	17 $9\frac{13}{16}$
4 $8\frac{3}{8}$	14 $8\frac{9}{16}$	4 $11\frac{3}{8}$	15 $5\frac{15}{16}$	5 $2\frac{3}{8}$	16 $3\frac{7}{16}$	5 $5\frac{3}{8}$	17 $0\frac{13}{16}$	5 $8\frac{3}{8}$	17 $10\frac{3}{16}$
4 $8\frac{1}{2}$	14 $8\frac{15}{16}$	4 $11\frac{1}{2}$	15 $6\frac{3}{8}$	5 $2\frac{1}{2}$	16 $3\frac{13}{16}$	5 $5\frac{1}{2}$	17 $1\frac{3}{16}$	5 $8\frac{1}{2}$	17 $10\frac{5}{8}$
4 $8\frac{5}{8}$	14 $9\frac{5}{16}$	4 $11\frac{5}{8}$	15 $6\frac{3}{4}$	5 $2\frac{5}{8}$	16 $4\frac{3}{16}$	5 $5\frac{5}{8}$	17 $1\frac{5}{8}$	5 $8\frac{5}{8}$	17 $11\frac{1}{16}$
4 $8\frac{3}{4}$	14 $9\frac{11}{16}$	4 $11\frac{3}{4}$	15 $7\frac{1}{8}$	5 $2\frac{3}{4}$	16 $4\frac{9}{16}$	5 $5\frac{3}{4}$	17 2	5 $8\frac{3}{4}$	17 $11\frac{9}{16}$
4 $8\frac{7}{8}$	14 $10\frac{1}{8}$	4 $11\frac{7}{8}$	15 $7\frac{1}{2}$	5 $2\frac{7}{8}$	16 $4\frac{15}{16}$	5 $5\frac{7}{8}$	17 $2\frac{3}{8}$	5 $8\frac{7}{8}$	17 $11\frac{13}{16}$
4 9	14 $10\frac{1}{2}$	5 0	15 $7\frac{7}{8}$	5 3	16 $5\frac{3}{8}$	5 6	17 $2\frac{3}{4}$	5 9	18 $0\frac{3}{16}$
4 $9\frac{1}{8}$	14 $10\frac{15}{16}$	5 $0\frac{1}{8}$	15 $8\frac{1}{4}$	5 $3\frac{1}{8}$	16 $5\frac{13}{16}$	5 $6\frac{1}{8}$	17 $3\frac{3}{16}$	5 $9\frac{1}{8}$	18 $0\frac{9}{16}$
4 $9\frac{1}{4}$	14 $11\frac{5}{16}$	5 $0\frac{1}{4}$	15 $8\frac{5}{8}$	5 $3\frac{1}{4}$	16 $6\frac{3}{16}$	5 $6\frac{1}{4}$	17 $3\frac{9}{16}$	5 $9\frac{1}{4}$	18 $0\frac{15}{16}$
4 $9\frac{3}{8}$	14 $11\frac{11}{16}$	5 $0\frac{3}{8}$	15 $9\frac{1}{16}$	5 $3\frac{3}{8}$	16 $6\frac{9}{16}$	5 $6\frac{3}{8}$	17 $3\frac{15}{16}$	5 $9\frac{3}{8}$	18 $1\frac{5}{16}$
4 $9\frac{1}{2}$	15 $0\frac{1}{16}$	5 $0\frac{1}{2}$	15 $9\frac{1}{2}$	5 $3\frac{1}{2}$	16 $6\frac{15}{16}$	5 $6\frac{1}{2}$	17 $4\frac{3}{8}$	5 $9\frac{1}{2}$	18 $1\frac{3}{4}$
4 $9\frac{5}{8}$	15 $0\frac{7}{16}$	5 $0\frac{5}{8}$	15 $9\frac{13}{16}$	5 $3\frac{5}{8}$	16 $7\frac{5}{16}$	5 $6\frac{5}{8}$	17 $4\frac{3}{4}$	5 $9\frac{5}{8}$	18 $2\frac{3}{16}$
4 $9\frac{3}{4}$	15 $0\frac{13}{16}$	5 $0\frac{3}{4}$	15 $10\frac{5}{16}$	5 $3\frac{3}{4}$	16 $7\frac{11}{16}$	5 $6\frac{3}{4}$	17 $5\frac{1}{8}$	5 $9\frac{3}{4}$	18 $2\frac{9}{16}$
4 $9\frac{7}{8}$	15 $1\frac{3}{16}$	5 $0\frac{7}{8}$	15 $10\frac{11}{16}$	5 $3\frac{7}{8}$	16 $8\frac{1}{16}$	5 $6\frac{7}{8}$	17 $5\frac{1}{2}$	5 $9\frac{7}{8}$	18 $2\frac{15}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	10	18	$3\frac{3}{8}$	6	1	19	$0\frac{3}{4}$	6	4	19	$10\frac{3}{16}$	6	7	20	$7\frac{5}{8}$	6	10	21	5
5	$10\frac{1}{8}$	18	$3\frac{13}{16}$	6	$1\frac{1}{8}$	19	$1\frac{1}{8}$	6	$4\frac{1}{8}$	19	$10\frac{9}{16}$	6	$7\frac{1}{8}$	20	$8\frac{1}{16}$	6	$10\frac{1}{8}$	21	$5\frac{7}{16}$
5	$10\frac{1}{4}$	18	$4\frac{3}{16}$	6	$1\frac{1}{4}$	19	$1\frac{9}{16}$	6	$4\frac{1}{4}$	19	$10\frac{15}{16}$	6	$7\frac{1}{4}$	20	$8\frac{7}{16}$	6	$10\frac{1}{4}$	21	$5\frac{13}{16}$
5	$10\frac{3}{8}$	18	$4\frac{9}{16}$	6	$1\frac{3}{8}$	19	$1\frac{15}{16}$	6	$4\frac{3}{8}$	19	$11\frac{5}{16}$	6	$7\frac{3}{8}$	20	$8\frac{13}{16}$	6	$10\frac{3}{8}$	21	$6\frac{3}{16}$
5	$10\frac{1}{2}$	18	$4\frac{15}{16}$	6	$1\frac{1}{2}$	19	$2\frac{3}{8}$	6	$4\frac{1}{2}$	19	$11\frac{3}{4}$	6	$7\frac{1}{2}$	20	$9\frac{3}{16}$	6	$10\frac{1}{2}$	21	$6\frac{9}{16}$
5	$10\frac{5}{8}$	18	$5\frac{5}{16}$	6	$1\frac{5}{8}$	19	$2\frac{3}{4}$	6	$4\frac{5}{8}$	20	$0\frac{3}{16}$	6	$7\frac{5}{8}$	20	$9\frac{9}{16}$	6	$10\frac{5}{8}$	21	7
5	$10\frac{3}{4}$	18	$5\frac{13}{16}$	6	$1\frac{3}{4}$	19	$3\frac{1}{8}$	6	$4\frac{3}{4}$	20	$0\frac{9}{16}$	6	$7\frac{3}{4}$	20	$9\frac{15}{16}$	6	$10\frac{3}{4}$	21	$7\frac{7}{16}$
5	$10\frac{7}{8}$	18	$6\frac{3}{16}$	6	$1\frac{7}{8}$	19	$3\frac{1}{2}$	6	$4\frac{7}{8}$	20	$0\frac{15}{16}$	6	$7\frac{7}{8}$	20	$10\frac{5}{16}$	6	$10\frac{7}{8}$	21	$7\frac{13}{16}$
5	11	18	$6\frac{9}{16}$	6	2	19	$3\frac{7}{8}$	6	5	20	$1\frac{3}{8}$	6	8	20	$10\frac{3}{4}$	6	11	21	$8\frac{3}{16}$
5	$11\frac{1}{8}$	18	$6\frac{15}{16}$	6	$2\frac{1}{8}$	19	$4\frac{5}{16}$	6	$5\frac{1}{8}$	20	$1\frac{3}{4}$	6	$8\frac{1}{8}$	20	$11\frac{3}{16}$	6	$11\frac{1}{8}$	21	$8\frac{9}{16}$
5	$11\frac{1}{4}$	18	$7\frac{5}{16}$	6	$2\frac{1}{4}$	19	$4\frac{11}{16}$	6	$5\frac{1}{4}$	20	$2\frac{1}{8}$	6	$8\frac{1}{4}$	20	$11\frac{9}{16}$	6	$11\frac{1}{4}$	21	$8\frac{15}{16}$
5	$11\frac{3}{8}$	18	$7\frac{11}{16}$	6	$2\frac{3}{8}$	19	$5\frac{1}{16}$	6	$5\frac{3}{8}$	20	$2\frac{1}{2}$	6	$8\frac{3}{8}$	20	$11\frac{15}{16}$	6	$11\frac{3}{8}$	21	$9\frac{5}{16}$
5	$11\frac{1}{2}$	18	$8\frac{1}{16}$	6	$2\frac{1}{2}$	19	$5\frac{1}{2}$	6	$5\frac{1}{2}$	20	$2\frac{7}{8}$	6	$8\frac{1}{2}$	21	$0\frac{5}{16}$	6	$11\frac{1}{4}$	21	$9\frac{3}{4}$
5	$11\frac{5}{8}$	18	$8\frac{7}{16}$	6	$2\frac{5}{8}$	19	$5\frac{15}{16}$	6	$5\frac{5}{8}$	20	$3\frac{5}{16}$	6	$8\frac{5}{8}$	21	$0\frac{11}{16}$	6	$11\frac{5}{8}$	21	$10\frac{3}{16}$
5	$11\frac{3}{4}$	18	$8\frac{13}{16}$	6	$2\frac{3}{4}$	19	$6\frac{5}{16}$	6	$5\frac{3}{4}$	20	$3\frac{11}{16}$	6	$8\frac{3}{4}$	21	$1\frac{1}{16}$	6	$11\frac{3}{4}$	21	$10\frac{9}{16}$
5	$11\frac{7}{8}$	18	$9\frac{3}{16}$	6	$2\frac{7}{8}$	19	$6\frac{11}{16}$	6	$5\frac{7}{8}$	20	$4\frac{1}{16}$	6	$8\frac{7}{8}$	21	$1\frac{7}{16}$	6	$11\frac{7}{8}$	21	$10\frac{15}{16}$
6	0	18	$9\frac{5}{8}$	6	3	19	$7\frac{1}{16}$	6	6	20	$4\frac{7}{16}$	6	9	21	$1\frac{7}{8}$	7	0	21	$11\frac{5}{16}$
6	$0\frac{1}{8}$	18	$10\frac{1}{16}$	6	$3\frac{1}{8}$	19	$7\frac{7}{16}$	6	$6\frac{1}{8}$	20	$4\frac{7}{8}$	6	$9\frac{1}{8}$	21	$2\frac{1}{16}$	7	$0\frac{1}{8}$	21	$11\frac{11}{16}$
6	$0\frac{1}{4}$	18	$10\frac{7}{16}$	6	$3\frac{1}{4}$	19	$7\frac{13}{16}$	6	$6\frac{1}{4}$	20	$5\frac{1}{16}$	6	$9\frac{1}{4}$	21	$2\frac{11}{16}$	7	$0\frac{1}{4}$	22	$0\frac{1}{16}$
6	$0\frac{3}{8}$	18	$10\frac{13}{16}$	6	$3\frac{3}{8}$	19	$8\frac{3}{16}$	6	$6\frac{3}{8}$	20	$5\frac{5}{16}$	6	$9\frac{3}{8}$	21	$3\frac{1}{16}$	7	$0\frac{3}{8}$	22	$0\frac{7}{16}$
6	$0\frac{1}{2}$	18	$11\frac{3}{16}$	6	$3\frac{1}{2}$	19	$8\frac{5}{8}$	6	$6\frac{1}{2}$	20	6	6	$9\frac{1}{2}$	21	$3\frac{7}{16}$	7	$0\frac{1}{2}$	22	$0\frac{7}{8}$
6	$0\frac{5}{8}$	18	$11\frac{9}{16}$	6	$3\frac{5}{8}$	19	$9\frac{1}{16}$	6	$6\frac{5}{8}$	20	$6\frac{7}{16}$	6	$9\frac{5}{8}$	21	$3\frac{7}{8}$	7	$0\frac{5}{8}$	22	$1\frac{5}{16}$
6	$0\frac{3}{4}$	19	0	6	$3\frac{3}{4}$	19	$9\frac{7}{16}$	6	$6\frac{3}{4}$	20	$6\frac{13}{16}$	6	$9\frac{3}{4}$	21	$4\frac{1}{4}$	7	$0\frac{3}{4}$	22	$1\frac{11}{16}$
6	$0\frac{7}{8}$	19	$0\frac{3}{8}$	6	$3\frac{7}{8}$	19	$9\frac{13}{16}$	6	$6\frac{7}{8}$	20	$7\frac{3}{16}$	6	$9\frac{7}{8}$	21	$4\frac{5}{8}$	7	$0\frac{7}{8}$	22	$2\frac{1}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	1	22	$2\frac{7}{16}$	7	4	22	$11\frac{7}{8}$	7	7	23	$9\frac{5}{16}$	7	10	24	$6\frac{3}{4}$
7	$1\frac{1}{8}$	22	$2\frac{7}{8}$	7	$4\frac{1}{8}$	23	$0\frac{5}{16}$	7	$7\frac{1}{8}$	23	$9\frac{11}{16}$	7	$10\frac{1}{8}$	24	$7\frac{3}{16}$
7	$1\frac{1}{4}$	22	$3\frac{1}{4}$	7	$4\frac{1}{4}$	23	$0\frac{11}{16}$	7	$7\frac{1}{4}$	23	$10\frac{1}{16}$	7	$10\frac{1}{4}$	24	$7\frac{9}{16}$
7	$1\frac{3}{8}$	22	$3\frac{5}{8}$	7	$4\frac{3}{8}$	23	$1\frac{1}{16}$	7	$7\frac{3}{8}$	23	$10\frac{7}{16}$	7	$10\frac{3}{8}$	24	$7\frac{15}{16}$
7	$1\frac{1}{2}$	22	4	7	$4\frac{1}{2}$	23	$1\frac{7}{16}$	7	$7\frac{1}{2}$	23	$10\frac{7}{8}$	7	$10\frac{1}{2}$	24	$8\frac{5}{16}$
7	$1\frac{5}{8}$	22	$4\frac{7}{16}$	7	$4\frac{5}{8}$	23	$1\frac{7}{8}$	7	$7\frac{5}{8}$	23	$11\frac{5}{16}$	7	$10\frac{5}{8}$	24	$8\frac{11}{16}$
7	$1\frac{3}{4}$	22	$4\frac{13}{16}$	7	$4\frac{3}{4}$	23	$2\frac{1}{4}$	7	$7\frac{3}{4}$	23	$11\frac{11}{16}$	7	$10\frac{3}{4}$	24	$9\frac{1}{16}$
7	$1\frac{7}{8}$	22	$5\frac{3}{16}$	7	$4\frac{7}{8}$	23	$2\frac{5}{8}$	7	$7\frac{7}{8}$	24	$0\frac{1}{16}$	7	$10\frac{7}{8}$	24	$9\frac{7}{16}$
7	2	22	$5\frac{9}{16}$	7	5	23	3	7	8	24	$0\frac{7}{16}$	7	11	24	$9\frac{7}{8}$
7	$2\frac{1}{8}$	22	6	7	$5\frac{1}{8}$	23	$3\frac{5}{8}$	7	$8\frac{1}{8}$	24	$0\frac{15}{16}$	7	$11\frac{1}{8}$	24	$10\frac{5}{16}$
7	$2\frac{1}{4}$	22	$6\frac{5}{8}$	7	$5\frac{1}{4}$	23	$3\frac{11}{16}$	7	$8\frac{1}{4}$	24	$1\frac{3}{16}$	7	$11\frac{1}{4}$	24	$10\frac{11}{16}$
7	$2\frac{3}{8}$	22	$6\frac{13}{16}$	7	$5\frac{3}{8}$	23	$4\frac{1}{16}$	7	$8\frac{3}{8}$	24	$1\frac{9}{16}$	7	$11\frac{3}{8}$	24	$11\frac{1}{16}$
7	$2\frac{1}{2}$	22	$7\frac{3}{16}$	7	$5\frac{1}{2}$	23	$4\frac{9}{16}$	7	$8\frac{1}{2}$	24	2	7	$11\frac{1}{2}$	24	$11\frac{7}{16}$
7	$2\frac{5}{8}$	22	$7\frac{5}{8}$	7	$5\frac{5}{8}$	23	5	7	$8\frac{5}{8}$	24	$2\frac{7}{16}$	7	$11\frac{5}{8}$	24	$11\frac{13}{16}$
7	$2\frac{3}{4}$	22	8	7	$5\frac{3}{4}$	23	$5\frac{7}{16}$	7	$8\frac{3}{4}$	24	$2\frac{13}{16}$	7	$11\frac{3}{4}$	25	$0\frac{3}{16}$
7	$2\frac{7}{8}$	22	$8\frac{3}{8}$	7	$5\frac{7}{8}$	23	$5\frac{13}{16}$	7	$8\frac{7}{8}$	24	$3\frac{3}{16}$	7	$11\frac{7}{8}$	25	$0\frac{9}{16}$
7	3	22	$8\frac{3}{4}$	7	6	23	$6\frac{3}{16}$	7	9	24	$3\frac{9}{16}$	8	0	25	1
7	$3\frac{1}{8}$	22	$9\frac{1}{16}$	7	$6\frac{1}{8}$	23	$6\frac{9}{16}$	7	$9\frac{1}{8}$	24	4	8	$0\frac{1}{2}$	25	$2\frac{5}{8}$
7	$3\frac{1}{4}$	22	$9\frac{7}{16}$	7	$6\frac{1}{4}$	23	$6\frac{15}{16}$	7	$9\frac{1}{4}$	24	$4\frac{3}{8}$	8	1	25	$4\frac{1}{8}$
7	$3\frac{3}{8}$	22	$9\frac{7}{8}$	7	$6\frac{3}{8}$	23	$7\frac{5}{16}$	7	$9\frac{3}{8}$	24	$4\frac{3}{4}$	8	$1\frac{1}{2}$	25	$5\frac{5}{8}$
7	$3\frac{1}{2}$	22	$10\frac{5}{16}$	7	$6\frac{1}{2}$	23	$7\frac{3}{4}$	7	$9\frac{1}{2}$	24	$5\frac{1}{8}$	8	2	25	$7\frac{5}{16}$
7	$3\frac{5}{8}$	22	$10\frac{11}{16}$	7	$6\frac{5}{8}$	23	$8\frac{3}{16}$	7	$9\frac{5}{8}$	24	$5\frac{1}{2}$	8	$2\frac{1}{2}$	25	$8\frac{7}{8}$
7	$3\frac{3}{4}$	22	$11\frac{1}{16}$	7	$6\frac{3}{4}$	23	$8\frac{9}{16}$	7	$9\frac{3}{4}$	24	$5\frac{7}{8}$	8	3	25	$10\frac{7}{16}$
7	$3\frac{7}{8}$	22	$11\frac{7}{16}$	7	$6\frac{7}{8}$	23	$8\frac{15}{16}$	7	$9\frac{7}{8}$	24	$6\frac{5}{16}$	8	$3\frac{1}{2}$	26	0

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ¼ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
0 10	2 6 11/16	1 1	3 4	1 4	4 1 1/2	1 7	4 10 15/16	1 10	5 8 1/2
0 10 1/8	2 7 1/16	1 1 1/8	3 4 7/16	1 4 1/8	4 1 15/16	1 7 1/8	4 11 5/16	1 10 1/8	5 8 7/8
0 10 1/4	2 7 7/16	1 1 1/4	3 4 7/8	1 4 1/4	4 2 5/16	1 7 1/4	4 11 11/16	1 10 1/4	5 9 5/16
0 10 3/8	2 7 7/8	1 1 3/8	3 5 1/4	1 4 3/8	4 2 11/16	1 7 3/8	5 0 1/16	1 10 3/8	5 9 11/16
0 10 1/2	2 8 5/16	1 1 1/2	3 5 5/8	1 4 1/2	4 3	1 7 1/2	5 0 9/16	1 10 1/2	5 10 1/8
0 10 5/8	2 8 3/8	1 1 5/8	3 6	1 4 5/8	4 3 3/8	1 7 5/8	5 0 7/8	1 10 5/8	5 10 7/16
0 10 3/4	2 9 1/16	1 1 3/4	3 6 7/16	1 4 3/4	4 3 13/16	1 7 3/4	5 1 1/4	1 10 3/4	5 10 13/16
0 10 7/8	2 9 3/8	1 1 7/8	3 6 13/16	1 4 7/8	4 4 3/16	1 7 7/8	5 1 11/16	1 10 7/8	5 11 1/4
0 11	2 9 13/16	1 2	3 7 3/16	1 5	4 4 11/16	1 8	5 2 1/8	1 11	5 11 11/16
0 11 1/8	2 10 1/8	1 2 1/8	3 7 9/16	1 5 1/8	4 5	1 8 1/8	5 2 7/16	1 11 1/8	6 0 1/8
0 11 1/4	2 10 9/16	1 2 1/4	3 8	1 5 1/4	4 5 7/16	1 8 1/4	5 2 13/16	1 11 1/4	6 0 1/2
0 11 3/8	2 11	1 2 3/8	3 8 3/8	1 5 3/8	4 5 3/4	1 8 3/8	5 3 3/16	1 11 3/8	6 0 7/8
0 11 1/2	2 11 3/8	1 2 1/2	3 8 13/16	1 5 1/2	4 6 3/16	1 8 1/2	5 3 11/16	1 11 1/2	6 1 3/16
0 11 5/8	2 11 3/4	1 2 5/8	3 9 1/4	1 5 5/8	4 6 9/16	1 8 5/8	5 4 1/16	1 11 5/8	6 1 9/16
0 11 3/4	3 0 3/16	1 2 3/4	3 9 5/8	1 5 3/4	4 7	1 8 3/4	5 4 7/16	1 11 3/4	6 1 15/16
0 11 7/8	3 0 1/2	1 2 7/8	3 10	1 5 7/8	4 7 3/8	1 8 7/8	5 4 3/4	1 11 7/8	6 2 5/16
1 0	3 0 15/16	1 3	3 10 3/8	1 6	4 7 13/16	1 9	5 5 3/16	2 0	6 2 13/16
1 0 1/8	3 1 1/4	1 3 1/8	3 10 13/16	1 6 1/8	4 8 1/8	1 9 1/8	5 5 9/16	2 0 1/8	6 3 3/16
1 0 1/4	3 1 11/16	1 3 1/4	3 11 3/16	1 6 1/4	4 8 1/2	1 9 1/4	5 6	2 0 1/4	6 3 5/8
1 0 3/8	3 2 1/8	1 3 3/8	3 11 9/16	1 6 3/8	4 8 13/16	1 9 3/8	5 6 3/8	2 0 3/8	6 3 15/16
1 0 1/2	3 2 1/2	1 3 1/2	4 0	1 6 1/2	4 9 5/16	1 9 1/2	5 6 3/4	2 0 1/2	6 4 5/16
1 0 5/8	3 2 7/8	1 3 5/8	4 0 5/16	1 6 5/8	4 9 3/4	1 9 5/8	5 7 1/8	2 0 5/8	6 4 3/4
1 0 3/4	3 3 1/4	1 3 3/4	4 0 11/16	1 6 3/4	4 10 3/16	1 9 3/4	5 7 9/16	2 0 3/4	6 5 1/8
1 0 7/8	3 3 5/8	1 3 7/8	4 1 1/16	1 6 7/8	4 10 1/2	1 9 7/8	5 7 15/16	2 0 7/8	6 5 1/2

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ¼ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued*.

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 5¾	2 4	7 3 3/16	2 7	8 0 11/16	2 10	8 10 1/16	3 1	9 7½
2 1⅛	6 6⅛	2 4⅛	7 3½	2 7⅛	8 1	2 10⅛	8 10½	3 1⅛	9 7⅞
2 1¼	6 6⅝	2 4¼	7 3⅞	2 7¼	8 1⅜	2 10¼	8 10 13/16	3 1¼	9 8 5/16
2 1⅜	6 6⅞	2 4⅜	7 4 5/16	2 7⅜	8 1¾	2 10⅜	8 11 3/16	3 1⅜	9 8⅝
2 1½	6 7¼	2 4½	7 4 13/16	2 7½	8 2⅛	2 10½	8 11⅝	3 1½	9 9 1/16
2 1⅝	6 7 11/16	2 4⅝	7 5⅛	2 7⅝	8 2½	2 10⅝	9 0	3 1⅝	9 9 7/16
2 1¾	6 8⅛	2 4¾	7 5½	2 7¾	8 2 15/16	2 10¾	9 0⅜	3 1¾	9 9 13/16
2 1⅞	6 8 9/16	2 4⅞	7 5⅞	2 7⅞	8 3 5/16	2 10⅞	9 0¾	3 1⅞	9 10 3/16
2 2	6 8 15/16	2 5	7 6¼	2 8	8 3 13/16	2 11	9 1 3/16	3 2	9 10 11/16
2 2⅛	6 9 5/16	2 5⅛	7 6⅝	2 8⅛	8 4⅛	2 11⅛	9 1½	3 2⅛	9 11 1/16
2 2¼	6 9 11/16	2 5¼	7 7	2 8¼	8 4½	2 11¼	9 1 15/16	3 2¼	9 11 7/16
2 2⅜	6 10 1/16	2 5⅜	7 7⅜	2 8⅜	8 4⅞	2 11⅜	9 2⅜	3 2⅜	9 11¾
2 2½	6 10½	2 5½	7 7¾	2 8½	8 5 5/16	2 11½	9 2¾	3 2½	10 0 1/16
2 2⅝	6 10⅞	2 5⅝	7 8¼	2 8⅝	8 5⅝	2 11⅝	9 3⅛	3 2⅝	10 0½
2 2¾	6 11 5/16	2 5¾	7 8⅝	2 8¾	8 6	2 11¾	9 3½	3 2¾	10 0⅞
2 2⅞	6 11 11/16	2 5⅞	7 9	2 8⅞	8 6⅜	2 11⅞	9 3⅞	3 2⅞	10 1 5/16
2 3	7 0⅛	2 6	7 9 7/16	2 9	8 6¾	3 0	9 4 5/16	3 3	10 1¾
2 3⅛	7 0 7/16	2 6⅛	7 9⅞	2 9⅛	8 7¼	3 0⅛	9 4 11/16	3 3⅛	10 2⅛
2 3¼	7 0 13/16	2 6¼	7 10¼	2 9¼	8 7 11/16	3 0¼	9 4 15/16	3 3¼	10 2 9/16
2 3⅜	7 1 3/16	2 6⅜	7 10⅝	2 9⅜	8 8	3 0⅜	9 5 7/16	3 3⅜	10 2 13/16
2 3½	7 1 11/16	2 6½	7 11 1/16	2 9½	8 8 7/16	3 0½	9 5 15/16	3 3½	10 3 3/16
2 3⅝	7 2	2 6⅝	7 11 7/16	2 9⅝	8 8 13/16	3 0⅝	9 6 5/16	3 3⅝	10 3 11/16
2 3¾	7 2⅜	2 6¾	7 11 13/16	2 9¾	8 9¼	3 0¾	9 6 11/16	3 3¾	10 4⅛
2 3⅞	7 2 13/16	2 6⅞	8 0 3/16	2 9⅞	8 9 11/16	3 0⅞	9 7⅛	3 3⅞	10 4½

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ¼ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 4	10 $4\frac{15}{16}$	3 7	11 $2\frac{5}{16}$	3 10	11 $11\frac{3}{4}$	4 1	12 $9\frac{3}{16}$	4 4	13 $6\frac{9}{16}$
3 $4\frac{1}{8}$	10 $5\frac{1}{4}$	3 $7\frac{1}{8}$	11 $2\frac{3}{4}$	3 $10\frac{1}{8}$	12 $0\frac{1}{8}$	4 $1\frac{1}{8}$	12 $9\frac{5}{8}$	4 $4\frac{1}{8}$	13 $6\frac{7}{8}$
3 $4\frac{1}{4}$	10 $5\frac{11}{16}$	3 $7\frac{1}{4}$	11 $3\frac{1}{8}$	3 $10\frac{1}{4}$	12 $0\frac{1}{2}$	4 $1\frac{1}{4}$	12 10	4 $4\frac{1}{4}$	13 $7\frac{5}{16}$
3 $4\frac{3}{8}$	10 $6\frac{1}{8}$	3 $7\frac{3}{8}$	11 $3\frac{1}{2}$	3 $10\frac{3}{8}$	12 $0\frac{7}{8}$	4 $1\frac{3}{8}$	12 $10\frac{3}{8}$	4 $4\frac{3}{8}$	13 $7\frac{3}{4}$
3 $4\frac{1}{2}$	10 $6\frac{1}{2}$	3 $7\frac{1}{2}$	11 $3\frac{7}{8}$	3 $10\frac{1}{2}$	12 $1\frac{1}{4}$	4 $1\frac{1}{2}$	12 $10\frac{13}{16}$	4 $4\frac{1}{2}$	13 $8\frac{3}{16}$
3 $4\frac{5}{8}$	10 $6\frac{7}{8}$	3 $7\frac{5}{8}$	11 $4\frac{1}{4}$	3 $10\frac{5}{8}$	12 $1\frac{5}{8}$	4 $1\frac{5}{8}$	12 $11\frac{3}{16}$	4 $4\frac{5}{8}$	13 $8\frac{9}{16}$
3 $4\frac{3}{4}$	10 $7\frac{5}{16}$	3 $7\frac{3}{4}$	11 $4\frac{5}{8}$	3 $10\frac{3}{4}$	12 2	4 $1\frac{3}{4}$	12 $11\frac{1}{2}$	4 $4\frac{3}{4}$	13 $8\frac{15}{16}$
3 $4\frac{7}{8}$	10 $7\frac{3}{4}$	3 $7\frac{7}{8}$	11 5	3 $10\frac{7}{8}$	12 $2\frac{11}{16}$	4 $1\frac{7}{8}$	12 $11\frac{7}{8}$	4 $4\frac{7}{8}$	13 $9\frac{5}{16}$
3 5	10 $8\frac{1}{16}$	3 8	11 $5\frac{7}{16}$	3 11	12 $2\frac{15}{16}$	4 2	13 $0\frac{5}{16}$	4 5	13 $9\frac{3}{4}$
3 $5\frac{1}{8}$	10 $8\frac{3}{8}$	3 $8\frac{1}{8}$	11 $5\frac{7}{8}$	3 $11\frac{1}{8}$	12 $3\frac{1}{4}$	4 $2\frac{1}{8}$	13 $0\frac{3}{4}$	4 $5\frac{1}{8}$	13 $10\frac{1}{8}$
3 $5\frac{1}{4}$	10 $8\frac{3}{4}$	3 $8\frac{1}{4}$	11 $6\frac{1}{4}$	3 $11\frac{1}{4}$	12 $3\frac{5}{8}$	4 $2\frac{1}{4}$	13 $1\frac{1}{8}$	4 $5\frac{1}{4}$	13 $10\frac{1}{2}$
3 $5\frac{3}{8}$	10 $9\frac{1}{8}$	3 $8\frac{3}{8}$	11 $6\frac{5}{8}$	3 $11\frac{3}{8}$	12 4	4 $2\frac{3}{8}$	13 $1\frac{1}{2}$	4 $5\frac{3}{8}$	13 $10\frac{7}{8}$
3 $5\frac{1}{2}$	10 $9\frac{1}{2}$	3 $8\frac{1}{2}$	11 7	3 $11\frac{1}{2}$	12 $4\frac{3}{8}$	4 $2\frac{1}{2}$	13 $1\frac{7}{8}$	4 $5\frac{1}{2}$	13 $11\frac{1}{4}$
3 $5\frac{5}{8}$	10 $9\frac{7}{8}$	3 $8\frac{5}{8}$	11 $7\frac{3}{8}$	3 $11\frac{5}{8}$	12 $4\frac{3}{4}$	4 $2\frac{5}{8}$	13 $2\frac{1}{4}$	4 $5\frac{5}{8}$	13 $11\frac{5}{8}$
3 $5\frac{3}{4}$	10 $10\frac{5}{16}$	3 $8\frac{3}{4}$	11 $7\frac{3}{4}$	3 $11\frac{3}{4}$	12 $5\frac{3}{16}$	4 $2\frac{3}{4}$	13 $2\frac{5}{8}$	4 $5\frac{3}{4}$	14 $0\frac{1}{16}$
3 $5\frac{7}{8}$	10 $10\frac{3}{4}$	3 $8\frac{7}{8}$	11 $8\frac{3}{16}$	3 $11\frac{7}{8}$	12 $5\frac{5}{8}$	4 $2\frac{7}{8}$	13 3	4 $5\frac{7}{8}$	14 $0\frac{7}{16}$
3 6	10 $11\frac{3}{16}$	3 9	11 $8\frac{5}{8}$	4 0	12 $6\frac{1}{16}$	4 3	13 $3\frac{7}{16}$	4 6	14 $0\frac{15}{16}$
3 $6\frac{1}{8}$	10 $11\frac{5}{8}$	3 $9\frac{1}{8}$	11 9	4 $0\frac{1}{8}$	12 $6\frac{7}{16}$	4 $3\frac{1}{8}$	13 $3\frac{7}{8}$	4 $6\frac{1}{8}$	14 $1\frac{5}{16}$
3 $6\frac{1}{4}$	11 0	3 $9\frac{1}{4}$	11 $9\frac{3}{8}$	4 $0\frac{1}{4}$	12 $6\frac{13}{16}$	4 $3\frac{1}{4}$	13 $4\frac{1}{4}$	4 $6\frac{1}{4}$	14 $1\frac{3}{4}$
3 $6\frac{3}{8}$	11 $0\frac{3}{8}$	3 $9\frac{3}{8}$	11 $9\frac{11}{16}$	4 $0\frac{3}{8}$	12 $7\frac{3}{16}$	4 $3\frac{3}{8}$	13 $4\frac{5}{8}$	4 $6\frac{3}{8}$	14 $2\frac{1}{8}$
3 $6\frac{1}{2}$	11 $0\frac{3}{4}$	3 $9\frac{1}{2}$	11 10	4 $0\frac{1}{2}$	12 $7\frac{1}{2}$	4 $3\frac{1}{2}$	13 5	4 $6\frac{1}{2}$	14 $2\frac{1}{2}$
3 $6\frac{5}{8}$	11 $1\frac{1}{8}$	3 $9\frac{5}{8}$	11 $10\frac{3}{8}$	4 $0\frac{5}{8}$	12 $7\frac{7}{8}$	4 $3\frac{5}{8}$	13 $5\frac{3}{8}$	4 $6\frac{5}{8}$	14 $2\frac{7}{8}$
3 $6\frac{3}{4}$	11 $1\frac{9}{16}$	3 $9\frac{3}{4}$	11 $10\frac{13}{16}$	4 $0\frac{3}{4}$	12 $8\frac{5}{16}$	4 $3\frac{3}{4}$	13 $5\frac{3}{4}$	4 $6\frac{3}{4}$	14 $3\frac{1}{4}$
3 $6\frac{7}{8}$	11 $1\frac{15}{16}$	3 $9\frac{7}{8}$	11 $11\frac{1}{4}$	4 $0\frac{7}{8}$	12 $8\frac{3}{4}$	4 $3\frac{7}{8}$	13 $6\frac{1}{8}$	4 $6\frac{7}{8}$	14 $3\frac{5}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ¼ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
4	7	14	4 1/16	4	10	15	1 7/16	5	1	15	10 7/8	5	4	16	8 5/16
4	7 1/8	14	4 7/16	4	10 1/8	15	1 13/16	5	1 1/8	15	11 1/4	5	4 1/8	16	8 3/4
4	7 1/4	14	4 7/8	4	10 1/4	15	2 1/4	5	1 1/4	15	11 5/8	5	4 1/4	16	9 1/8
4	7 3/8	14	5 1/4	4	10 3/8	15	2 11/16	5	1 3/8	16	0	5	4 3/8	16	9 1/2
4	7 1/2	14	5 5/8	4	10 1/2	15	3 1/16	5	1 1/2	16	0 7/16	5	4 1/2	16	9 7/8
4	7 5/8	14	6	4	10 5/8	15	3 7/16	5	1 5/8	16	0 13/16	5	4 5/8	16	10 1/4
4	7 3/4	14	6 7/16	4	10 3/4	15	3 13/16	5	1 3/4	16	1 1/4	5	4 3/4	16	10 5/8
4	7 7/8	14	6 13/16	4	10 7/8	15	4 3/16	5	1 7/8	16	1 5/8	5	4 7/8	16	11 1/16
4	8	14	7 3/16	4	11	15	4 9/16	5	2	16	2 1/16	5	5	16	11 7/16
4	8 1/8	14	7 5/8	4	11 1/8	15	4 15/16	5	2 1/8	16	2 7/16	5	5 1/8	16	11 7/8
4	8 1/4	14	8	4	11 1/4	15	5 5/16	5	2 1/4	16	2 7/8	5	5 1/4	17	0 1/4
4	8 3/8	14	8 3/8	4	11 3/8	15	5 13/16	5	2 3/8	16	3 1/4	5	5 3/8	17	0 5/8
4	8 1/2	14	8 3/4	4	11 1/2	15	6 3/16	5	2 1/2	16	3 5/8	5	5 1/2	17	1 1/16
4	8 5/8	14	9 1/8	4	11 5/8	15	6 9/16	5	2 5/8	16	4	5	5 5/8	17	1 7/16
4	8 3/4	14	9 1/2	4	11 3/4	15	6 15/16	5	2 3/4	16	4 3/8	5	5 3/4	17	1 13/16
4	8 7/8	14	9 15/16	4	11 7/8	15	7 5/16	5	2 7/8	16	4 13/16	5	5 7/8	17	2 3/16
4	9	14	10 5/16	5	0	15	7 11/16	5	3	16	5 3/16	5	6	17	2 9/16
4	9 1/8	14	10 3/4	5	0 1/8	15	8 1/16	5	3 1/8	16	5 5/8	5	6 1/8	17	3
4	9 1/4	14	11 1/8	5	0 1/4	15	8 7/16	5	3 1/4	16	6	5	6 1/4	17	3 3/8
4	9 3/8	14	11 1/2	5	0 3/8	15	8 7/8	5	3 3/8	16	6 3/8	5	6 3/8	17	3 3/4
4	9 1/2	14	11 7/8	5	0 1/2	15	9 5/16	5	3 1/2	16	6 3/4	5	6 1/2	17	4 3/16
4	9 5/8	15	0 1/4	5	0 5/8	15	9 3/4	5	3 5/8	16	7 1/8	5	6 5/8	17	4 9/16
4	9 3/4	15	0 5/8	5	0 3/4	15	10 1/8	5	3 3/4	16	7 1/2	5	6 3/4	17	4 15/16
4	9 7/8	15	1 1/16	5	0 7/8	15	10 1/2	5	3 7/8	16	7 15/16	5	6 7/8	17	5 5/16

Diam.		Circum.	
ft.	in.	ft.	in.
5	7	17	5 11/16
5	7 1/8	17	6 1/16
5	7 1/4	17	6 1/2
5	7 3/8	17	6 7/8
5	7 1/2	17	7 5/16
5	7 5/8	17	7 3/4
5	7 3/4	17	8 1/8
5	7 7/8	17	8 1/2
5	8	17	8 7/8
5	8 1/8	17	9 1/4
5	8 1/4	17	9 5/8
5	8 3/8	17	10
5	8 1/2	17	10 7/16
5	8 5/8	17	10 7/8
5	8 3/4	17	11 1/4
5	8 7/8	17	11 5/8
5	9	18	0
5	9 1/8	18	0 3/8
5	9 1/4	18	0 3/4
5	9 3/8	18	1 1/8
5	9 1/2	18	1 9/16
5	9 5/8	18	2
5	9 3/4	18	2 3/8
5	9 7/8	18	2 3/4

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ¼ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	10	18	3 3/16	6	1	19	0 9/16	6	4	19	10	6	7	20	7 7/16
5	10 1/8	18	3 5/8	6	1 1/8	19	0 15/16	6	4 1/8	19	10 3/8	6	7 1/8	20	7 7/8
5	10 1/4	18	4	6	1 1/4	19	1 3/8	6	4 1/4	19	10 3/4	6	7 1/4	20	8 1/4
5	10 3/8	18	4 3/8	6	1 3/8	19	1 1 3/16	6	4 3/8	19	11 1/8	6	7 3/8	20	8 5/8
5	10 1/2	18	4 3/4	6	1 1/2	19	2 3/16	6	4 1/2	19	11 9/16	6	7 1/2	20	9
5	10 5/8	18	5 1/8	6	1 5/8	19	2 9/16	6	4 5/8	20	0	6	7 5/8	20	9 3/8
5	10 3/4	18	5 5/8	6	1 3/4	19	2 1 5/16	6	4 3/4	20	0 3/8	6	7 3/4	20	9 3/4
5	10 7/8	18	6	6	1 7/8	19	3 5/16	6	4 7/8	20	0 1 3/16	6	7 7/8	20	10 3/16
5	11	18	6 3/8	6	2	19	3 1 1/16	6	5	20	1 3/16	6	8	20	10 9/16
5	11 1/8	18	6 3/4	6	2 1/8	19	4 1/8	6	5 1/8	20	1 9/16	6	8 1/8	20	11
5	11 1/4	18	7 1/8	6	2 1/4	19	4 1/2	6	5 1/4	20	1 1 5/16	6	8 1/4	20	11 3/8
5	11 3/8	18	7 1/2	6	2 3/8	19	4 7/8	6	5 3/8	20	2 5/16	6	8 3/8	20	11 3/4
5	11 1/2	18	7 7/8	6	2 1/2	19	5 5/16	6	5 1/2	20	2 1 1/16	6	8 1/2	21	0 1/8
5	11 5/8	18	8 1/4	6	2 5/8	19	5 3/4	6	5 5/8	20	3 1/8	6	8 5/8	21	0 1/2
5	11 3/4	18	8 5/8	6	2 3/4	19	6 1/8	6	5 3/4	20	3 1/2	6	8 3/4	21	0 7/8
5	11 7/8	18	9	6	2 7/8	19	6 1/2	6	5 7/8	20	3 7/8	6	8 7/8	21	1 1/4
6	0	18	9 7/16	6	3	19	6 7/8	6	6	20	4 5/16	6	9	21	1 1 1/16
6	0 1/8	18	9 15/16	6	3 1/8	19	7 1/4	6	6 1/8	20	4 1 1/16	6	9 1/8	21	2 1/16
6	0 1/4	18	10 1/4	6	3 1/4	19	7 5/8	6	6 1/4	20	5 1/16	6	9 1/4	21	2 1/2
6	0 3/8	18	10 5/8	6	3 3/8	19	8	6	6 3/8	20	5 7/16	6	9 3/8	21	2 7/8
6	0 1/2	18	11 1/16	6	3 1/2	19	8 7/16	6	6 1/2	20	5 1 3/16	6	9 1/2	21	3 5/16
6	0 5/8	18	11 7/16	6	3 5/8	19	8 7/8	6	6 5/8	20	6 1/4	6	9 5/8	21	3 1 1/16
6	0 3/4	18	11 1 3/16	6	3 3/4	19	9 1/4	6	6 3/4	20	6 5/8	6	9 3/4	21	4 1/16
6	0 7/8	19	0 3/16	6	3 7/8	19	9 5/8	6	6 7/8	20	7	6	9 7/8	21	4 7/16

Diam.		Circum.	
ft.	in.	ft.	in.
6	10	21	4 1 3/16
6	10 1/8	21	5 1/4
6	10 1/4	21	5 5/8
6	10 3/8	21	6
6	10 1/2	21	6 7/16
6	10 5/8	21	6 1 3/16
6	10 3/4	21	7 1/4
6	10 7/8	21	7 5/8
6	11	21	8
6	11 1/8	21	8 3/8
6	11 1/4	21	8 3/4
6	11 3/8	21	9 1/8
6	11 1/2	21	9 9/16
6	11 5/8	21	10
6	11 3/4	21	10 3/8
6	11 7/8	21	10 3/4
7	0	21	11 1/8
7	0 1/8	21	11 1/2
7	0 1/4	21	11 7/8
7	0 3/8	22	0 1/4
7	0 1/2	22	0 1 1/16
7	0 5/8	22	1 1/8
7	0 3/4	22	1 1/2
7	0 7/8	22	1 7/8

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ¼ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	1	22	$2\frac{5}{16}$	7	4	22	$11\frac{11}{16}$	7	7	23	$9\frac{1}{8}$	7	10	24	$6\frac{9}{16}$	8	1	25	$3\frac{15}{16}$
7	$1\frac{1}{8}$	22	$2\frac{11}{16}$	7	$4\frac{1}{8}$	23	$0\frac{1}{8}$	7	$7\frac{1}{8}$	23	$9\frac{1}{2}$	7	$10\frac{1}{8}$	24	7	8	$1\frac{1}{8}$	25	$4\frac{3}{8}$
7	$1\frac{1}{4}$	22	$3\frac{1}{16}$	7	$4\frac{1}{4}$	23	$0\frac{1}{2}$	7	$7\frac{1}{4}$	23	$9\frac{7}{8}$	7	$10\frac{1}{4}$	24	$7\frac{3}{8}$	8	$1\frac{1}{4}$	25	$4\frac{3}{4}$
7	$1\frac{3}{8}$	22	$3\frac{11}{16}$	7	$4\frac{3}{8}$	23	$0\frac{7}{8}$	7	$7\frac{3}{8}$	23	$10\frac{5}{16}$	7	$10\frac{3}{8}$	24	$7\frac{3}{4}$	8	$1\frac{3}{8}$	25	$5\frac{1}{8}$
7	$1\frac{1}{2}$	22	$3\frac{13}{16}$	7	$4\frac{1}{2}$	23	$1\frac{5}{16}$	7	$7\frac{1}{2}$	23	$10\frac{11}{16}$	7	$10\frac{1}{2}$	24	$8\frac{1}{8}$	8	$1\frac{1}{2}$	25	$5\frac{1}{2}$
7	$1\frac{5}{8}$	22	$4\frac{1}{4}$	7	$4\frac{5}{8}$	23	$1\frac{11}{16}$	7	$7\frac{5}{8}$	23	$11\frac{1}{8}$	7	$10\frac{5}{8}$	24	$8\frac{1}{2}$	8	$1\frac{5}{8}$	25	$5\frac{7}{8}$
7	$1\frac{3}{4}$	22	$4\frac{5}{8}$	7	$4\frac{3}{4}$	23	$2\frac{1}{16}$	7	$7\frac{3}{4}$	23	$11\frac{1}{2}$	7	$10\frac{3}{4}$	24	$8\frac{7}{8}$	8	$1\frac{3}{4}$	25	$6\frac{5}{16}$
7	$1\frac{7}{8}$	22	5	7	$4\frac{7}{8}$	23	$2\frac{7}{16}$	7	$7\frac{7}{8}$	23	$11\frac{7}{8}$	7	$10\frac{7}{8}$	24	$9\frac{1}{4}$	8	$1\frac{7}{8}$	25	$6\frac{3}{4}$
7	2	22	$5\frac{7}{16}$	7	5	23	$2\frac{13}{16}$	7	8	24	$0\frac{1}{4}$	7	11	24	$9\frac{11}{16}$	8	2	25	$7\frac{1}{8}$
7	$2\frac{1}{8}$	22	$5\frac{13}{16}$	7	$5\frac{1}{8}$	23	$3\frac{3}{16}$	7	$8\frac{1}{8}$	24	$0\frac{5}{8}$	7	$11\frac{1}{8}$	24	$10\frac{1}{8}$	8	$2\frac{1}{8}$	25	$7\frac{1}{2}$
7	$2\frac{1}{4}$	22	$6\frac{3}{16}$	7	$5\frac{1}{4}$	23	$3\frac{1}{2}$	7	$8\frac{1}{4}$	24	1	7	$11\frac{1}{4}$	24	$10\frac{1}{2}$	8	$2\frac{1}{4}$	25	$7\frac{15}{16}$
7	$2\frac{3}{8}$	22	$6\frac{5}{8}$	7	$5\frac{3}{8}$	23	$3\frac{7}{8}$	7	$8\frac{3}{8}$	24	$1\frac{7}{16}$	7	$11\frac{3}{8}$	24	$10\frac{7}{8}$	8	$2\frac{3}{8}$	25	$8\frac{5}{16}$
7	$2\frac{1}{2}$	22	7	7	$5\frac{1}{2}$	23	$4\frac{7}{16}$	7	$8\frac{1}{2}$	24	$1\frac{13}{16}$	7	$11\frac{1}{2}$	24	$11\frac{1}{4}$	8	$2\frac{1}{2}$	25	$8\frac{11}{16}$
7	$2\frac{5}{8}$	22	$7\frac{7}{16}$	7	$5\frac{5}{8}$	23	$4\frac{13}{16}$	7	$8\frac{5}{8}$	24	$2\frac{1}{4}$	7	$11\frac{5}{8}$	24	$11\frac{5}{8}$				
7	$2\frac{3}{4}$	22	$7\frac{13}{16}$	7	$5\frac{3}{4}$	23	$5\frac{1}{4}$	7	$8\frac{3}{4}$	24	$2\frac{5}{8}$	7	$11\frac{3}{4}$	25	0				
7	$2\frac{7}{8}$	22	$8\frac{3}{16}$	7	$5\frac{7}{8}$	23	$5\frac{5}{8}$	7	$8\frac{7}{8}$	24	3	7	$11\frac{7}{8}$	25	$0\frac{7}{16}$				
7	3	22	$8\frac{9}{16}$	7	6	23	6	7	9	24	$3\frac{7}{16}$	8	0	25	$0\frac{13}{16}$				
7	$3\frac{1}{8}$	22	$8\frac{7}{8}$	7	$6\frac{1}{8}$	23	$6\frac{3}{8}$	7	$9\frac{1}{8}$	24	$3\frac{13}{16}$	8	$0\frac{1}{8}$	25	$1\frac{1}{4}$				
7	$3\frac{1}{4}$	22	$9\frac{1}{4}$	7	$6\frac{1}{4}$	23	$6\frac{3}{4}$	7	$9\frac{1}{4}$	24	$4\frac{3}{16}$	8	$0\frac{1}{4}$	25	$1\frac{5}{8}$				
7	$3\frac{3}{8}$	22	$9\frac{11}{16}$	7	$6\frac{3}{8}$	23	$7\frac{3}{16}$	7	$9\frac{3}{8}$	24	$4\frac{9}{16}$	8	$0\frac{3}{8}$	25	2				
7	$3\frac{1}{2}$	22	$10\frac{1}{8}$	7	$6\frac{1}{2}$	23	$7\frac{9}{16}$	7	$9\frac{1}{2}$	24	$4\frac{15}{16}$	8	$0\frac{1}{2}$	25	$2\frac{7}{16}$				
7	$3\frac{5}{8}$	22	$10\frac{1}{2}$	7	$6\frac{5}{8}$	23	8	7	$9\frac{5}{8}$	24	$5\frac{1}{4}$	8	$0\frac{5}{8}$	25	$2\frac{13}{16}$				
7	$3\frac{3}{4}$	22	$10\frac{7}{8}$	7	$6\frac{3}{4}$	23	$8\frac{3}{8}$	7	$9\frac{3}{4}$	24	$5\frac{11}{16}$	8	$0\frac{3}{4}$	25	$3\frac{3}{16}$				
7	$3\frac{7}{8}$	22	$11\frac{1}{4}$	7	$6\frac{7}{8}$	23	$8\frac{3}{4}$	7	$9\frac{7}{8}$	24	$6\frac{1}{8}$	8	$0\frac{7}{8}$	25	$3\frac{9}{16}$				

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{5}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
0	10	2	6½	1	1	3	3 13/16	1	4	4	1 5/16	1	7	4	10 13/16	1	10	5	8 5/16
0	10⅛	2	6⅞	1	1⅛	3	4 3/16	1	4⅛	4	1 11/16	1	7⅛	4	11⅛	1	10⅛	5	8 11/16
0	10¼	2	7¼	1	1¼	3	4 11/16	1	4¼	4	2⅛	1	7¼	4	11 9/16	1	10¼	5	9⅛
0	10⅜	2	7 11/16	1	1⅜	3	5 1/16	1	4⅜	4	2 7/16	1	7⅜	4	11 15/16	1	10⅜	5	9½
0	10½	2	8⅛	1	1½	3	5 7/16	1	4½	4	2 15/16	1	7½	5	0 5/16	1	10½	5	9 15/16
0	10⅝	2	8 7/16	1	1⅝	3	5 13/16	1	4⅝	4	3¼	1	7⅝	5	0 11/16	1	10⅝	5	10¼
0	10¾	2	8 13/16	1	1¾	3	6 3/16	1	4¾	4	3 9/16	1	7¾	5	1 1/16	1	10¾	5	10 11/16
0	10⅞	2	9 3/16	1	1⅞	3	6 9/16	1	4⅞	4	3 15/16	1	7⅞	5	1½	1	10⅞	5	11 1/16
0	11	2	9 9/16	1	2	3	7	1	5	4	4½	1	8	5	1 15/16	1	11	5	11½
0	11⅛	2	9 15/16	1	2⅛	3	7 5/16	1	5⅛	4	4 13/16	1	8⅛	5	2 3/16	1	11⅛	5	11 15/16
0	11¼	2	10⅜	1	2¼	3	7 13/16	1	5¼	4	5¼	1	8¼	5	2 11/16	1	11¼	6	0 5/16
0	11⅜	2	10 13/16	1	2⅜	3	8 3/16	1	5⅜	4	5 9/16	1	8⅜	5	3	1	11⅜	6	0 11/16
0	11½	2	11 3/16	1	2½	3	8 9/16	1	5½	4	6	1	8½	5	3 7/16	1	11½	6	1
0	11⅝	2	11 9/16	1	2⅝	3	9 1/16	1	5⅝	4	6⅜	1	8⅝	5	3 13/16	1	11⅝	6	1⅜
0	11¾	3	0	1	2¾	3	9⅜	1	5¾	4	6 13/16	1	8¾	5	4¼	1	11¾	6	1 3/16
0	11⅞	3	0⅜	1	2⅞	3	9 13/16	1	5⅞	4	7 3/16	1	8⅞	5	4⅝	1	11⅞	6	2 3/16
1	0	3	0¾	1	3	3	10 3/16	1	6	4	7 9/16	1	9	5	5	2	0	6	2⅝
1	0⅛	3	1⅛	1	3⅛	3	10 9/16	1	6⅛	4	7 15/16	1	9⅛	5	5⅜	2	0⅛	6	3
1	0¼	3	1 7/16	1	3¼	3	10 15/16	1	6¼	4	8 5/16	1	9¼	5	5 13/16	2	0¼	6	3 7/16
1	0⅜	3	1 15/16	1	3⅜	3	11⅜	1	6⅜	4	8 11/16	1	9⅜	5	6 3/16	2	0⅜	6	3 13/16
1	0½	3	2 5/16	1	3½	3	11 13/16	1	6½	4	9⅛	1	9½	5	6 9/16	2	0½	6	4 3/16
1	0⅝	3	2 11/16	1	3⅝	4	0 1/16	1	6⅝	4	9 9/16	1	9⅝	5	6 15/16	2	0⅝	6	4 9/16
1	0¾	3	3 1/16	1	3¾	4	0⅜	1	6¾	4	9 15/16	1	9¾	5	7⅜	2	0¾	6	4 15/16
1	0⅞	3	3 7/16	1	3⅞	4	0 13/16	1	6⅞	4	10 5/16	1	9⅞	5	7 11/16	2	0⅞	6	5 3/16

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{5}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
2	1	6	$5\frac{9}{16}$	2	4	7	$2\frac{15}{16}$	2	7	8	$0\frac{7}{16}$	2	10	8	$9\frac{7}{8}$	3	1	9	$7\frac{5}{16}$
2	$1\frac{1}{8}$	6	$5\frac{15}{16}$	2	$4\frac{1}{8}$	7	$3\frac{5}{16}$	2	$7\frac{1}{8}$	8	$0\frac{13}{16}$	2	$10\frac{1}{8}$	8	$10\frac{5}{16}$	3	$1\frac{1}{8}$	9	$7\frac{11}{16}$
2	$1\frac{1}{4}$	6	$6\frac{3}{8}$	2	$4\frac{1}{4}$	7	$3\frac{11}{16}$	2	$7\frac{1}{4}$	8	$1\frac{3}{16}$	2	$10\frac{1}{4}$	8	$10\frac{5}{8}$	3	$1\frac{1}{4}$	9	$8\frac{1}{8}$
2	$1\frac{3}{8}$	6	$6\frac{11}{16}$	2	$4\frac{3}{8}$	7	$4\frac{1}{8}$	2	$7\frac{3}{8}$	8	$1\frac{9}{16}$	2	$10\frac{3}{8}$	8	11	3	$1\frac{3}{8}$	9	$8\frac{7}{16}$
2	$1\frac{1}{2}$	6	$7\frac{1}{16}$	2	$4\frac{1}{2}$	7	$4\frac{9}{16}$	2	$7\frac{1}{2}$	8	$1\frac{15}{16}$	2	$10\frac{1}{2}$	8	$11\frac{7}{16}$	3	$1\frac{1}{2}$	9	$8\frac{7}{8}$
2	$1\frac{5}{8}$	6	$7\frac{1}{2}$	2	$4\frac{5}{8}$	7	$4\frac{15}{16}$	2	$7\frac{5}{8}$	8	$2\frac{5}{16}$	2	$10\frac{5}{8}$	8	$11\frac{13}{16}$	3	$1\frac{5}{8}$	9	$9\frac{1}{4}$
2	$1\frac{3}{4}$	6	$7\frac{15}{16}$	2	$4\frac{3}{4}$	7	$5\frac{5}{16}$	2	$7\frac{3}{4}$	8	$2\frac{3}{4}$	2	$10\frac{3}{4}$	9	$0\frac{3}{16}$	3	$1\frac{3}{4}$	9	$9\frac{9}{16}$
2	$1\frac{7}{8}$	6	$8\frac{5}{16}$	2	$4\frac{7}{8}$	7	$5\frac{11}{16}$	2	$7\frac{7}{8}$	8	$3\frac{1}{8}$	2	$10\frac{7}{8}$	9	$0\frac{9}{16}$	3	$1\frac{7}{8}$	9	10
2	2	6	$8\frac{3}{4}$	2	5	7	$6\frac{1}{16}$	2	8	8	$3\frac{9}{16}$	2	11	9	1	3	2	9	$10\frac{1}{2}$
2	$2\frac{1}{8}$	6	$9\frac{1}{8}$	2	$5\frac{1}{8}$	7	$6\frac{7}{16}$	2	$8\frac{1}{8}$	8	$3\frac{15}{16}$	2	$11\frac{1}{8}$	9	$1\frac{5}{16}$	3	$2\frac{1}{8}$	9	$10\frac{7}{8}$
2	$2\frac{1}{4}$	6	$9\frac{1}{2}$	2	$5\frac{1}{4}$	7	$6\frac{13}{16}$	2	$8\frac{1}{4}$	8	$4\frac{5}{16}$	2	$11\frac{1}{4}$	9	$1\frac{3}{4}$	3	$2\frac{1}{4}$	9	$11\frac{3}{16}$
2	$2\frac{3}{8}$	6	$9\frac{7}{8}$	2	$5\frac{3}{8}$	7	$7\frac{3}{16}$	2	$8\frac{3}{8}$	8	$4\frac{11}{16}$	2	$11\frac{3}{8}$	9	$2\frac{3}{16}$	3	$2\frac{3}{8}$	9	$11\frac{9}{16}$
2	$2\frac{1}{2}$	6	$10\frac{5}{16}$	2	$5\frac{1}{2}$	7	$7\frac{11}{16}$	2	$8\frac{1}{2}$	8	$5\frac{1}{8}$	2	$11\frac{1}{2}$	9	$2\frac{9}{16}$	3	$2\frac{1}{2}$	9	$11\frac{15}{16}$
2	$2\frac{5}{8}$	6	$10\frac{11}{16}$	2	$5\frac{5}{8}$	7	$8\frac{1}{16}$	2	$8\frac{5}{8}$	8	$5\frac{7}{16}$	2	$11\frac{5}{8}$	9	$2\frac{15}{16}$	3	$2\frac{5}{8}$	10	$0\frac{5}{16}$
2	$2\frac{3}{4}$	6	$11\frac{1}{8}$	2	$5\frac{3}{4}$	7	$8\frac{7}{16}$	2	$8\frac{3}{4}$	8	$5\frac{15}{16}$	2	$11\frac{3}{4}$	9	$3\frac{5}{16}$	3	$2\frac{3}{4}$	10	$0\frac{11}{16}$
2	$2\frac{7}{8}$	6	$11\frac{1}{2}$	2	$5\frac{7}{8}$	7	$8\frac{13}{16}$	2	$8\frac{7}{8}$	8	$6\frac{3}{16}$	2	$11\frac{7}{8}$	9	$3\frac{11}{16}$	3	$2\frac{7}{8}$	10	$1\frac{1}{8}$
2	3	7	0	2	6	7	$9\frac{1}{4}$	2	9	8	$6\frac{3}{8}$	3	0	9	$4\frac{1}{8}$	3	3	10	$1\frac{9}{16}$
2	$3\frac{1}{8}$	7	$0\frac{5}{16}$	2	$6\frac{1}{8}$	7	$9\frac{11}{16}$	2	$9\frac{1}{8}$	8	$7\frac{1}{16}$	3	$0\frac{1}{8}$	9	$4\frac{1}{2}$	3	$3\frac{1}{8}$	10	$1\frac{15}{16}$
2	$3\frac{1}{4}$	7	$0\frac{5}{8}$	2	$6\frac{1}{4}$	7	$10\frac{1}{16}$	2	$9\frac{1}{4}$	8	$7\frac{1}{2}$	3	$0\frac{1}{4}$	9	$4\frac{13}{16}$	3	$3\frac{1}{4}$	10	$2\frac{3}{8}$
2	$3\frac{3}{8}$	7	1	2	$6\frac{3}{8}$	7	$10\frac{7}{16}$	2	$9\frac{3}{8}$	8	$7\frac{13}{16}$	3	$0\frac{3}{8}$	9	$5\frac{3}{16}$	3	$3\frac{3}{8}$	10	$2\frac{5}{8}$
2	$3\frac{1}{2}$	7	$1\frac{7}{16}$	2	$6\frac{1}{2}$	7	$10\frac{7}{8}$	2	$9\frac{1}{2}$	8	$8\frac{1}{4}$	3	$0\frac{1}{2}$	9	$5\frac{3}{4}$	3	$3\frac{1}{2}$	10	3
2	$3\frac{5}{8}$	7	$1\frac{13}{16}$	2	$6\frac{5}{8}$	7	$11\frac{3}{16}$	2	$9\frac{5}{8}$	8	$8\frac{5}{8}$	3	$0\frac{5}{8}$	9	$6\frac{1}{8}$	3	$3\frac{5}{8}$	10	$3\frac{1}{2}$
2	$3\frac{3}{4}$	7	$2\frac{3}{16}$	2	$6\frac{3}{4}$	7	$11\frac{5}{8}$	2	$9\frac{3}{4}$	8	$9\frac{1}{16}$	3	$0\frac{3}{4}$	9	$6\frac{1}{2}$	3	$3\frac{3}{4}$	10	$3\frac{15}{16}$
2	$3\frac{7}{8}$	7	$2\frac{5}{8}$	2	$6\frac{7}{8}$	8	0	2	$9\frac{7}{8}$	8	$9\frac{1}{2}$	3	$0\frac{7}{8}$	9	$6\frac{15}{16}$	3	$3\frac{7}{8}$	10	$4\frac{5}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{5}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in	ft. in.	ft. in.
3 4	10 $4\frac{11}{16}$	3 7	11 $2\frac{1}{8}$	3 10	11 $11\frac{9}{16}$	4 1	12 9	4 4	13 $6\frac{3}{8}$
3 $4\frac{1}{8}$	10 $5\frac{1}{16}$	3 $7\frac{1}{8}$	11 $2\frac{9}{16}$	3 $10\frac{1}{8}$	11 $11\frac{15}{16}$	4 $1\frac{1}{8}$	12 $9\frac{7}{16}$	4 $4\frac{1}{8}$	13 $6\frac{11}{16}$
3 $4\frac{1}{4}$	10 $5\frac{1}{8}$	3 $7\frac{1}{4}$	11 $2\frac{15}{16}$	3 $10\frac{1}{4}$	12 $0\frac{5}{16}$	4 $1\frac{1}{4}$	12 $9\frac{13}{16}$	4 $4\frac{1}{4}$	13 $7\frac{1}{8}$
3 $4\frac{3}{8}$	10 $5\frac{15}{16}$	3 $7\frac{3}{8}$	11 $3\frac{5}{16}$	3 $10\frac{3}{8}$	12 $0\frac{11}{16}$	4 $1\frac{3}{8}$	12 $10\frac{3}{16}$	4 $4\frac{3}{8}$	13 $7\frac{9}{16}$
3 $4\frac{1}{2}$	10 $6\frac{5}{16}$	3 $7\frac{1}{2}$	11 $3\frac{11}{16}$	3 $10\frac{1}{2}$	12 $1\frac{1}{16}$	4 $1\frac{1}{2}$	12 $10\frac{5}{8}$	4 $4\frac{1}{2}$	13 8
3 $4\frac{5}{8}$	10 $6\frac{11}{16}$	3 $7\frac{5}{8}$	11 $4\frac{1}{16}$	3 $10\frac{5}{8}$	12 $1\frac{7}{16}$	4 $1\frac{5}{8}$	12 11	4 $4\frac{5}{8}$	13 $8\frac{3}{8}$
3 $4\frac{3}{4}$	10 $7\frac{1}{16}$	3 $7\frac{3}{4}$	11 $4\frac{7}{16}$	3 $10\frac{3}{4}$	12 $1\frac{13}{16}$	4 $1\frac{3}{4}$	12 $11\frac{5}{16}$	4 $4\frac{3}{4}$	13 $8\frac{11}{16}$
3 $4\frac{7}{8}$	10 $7\frac{1}{2}$	3 $7\frac{7}{8}$	11 $4\frac{13}{16}$	3 $10\frac{7}{8}$	12 $2\frac{1}{4}$	4 $1\frac{7}{8}$	12 $11\frac{11}{16}$	4 $4\frac{7}{8}$	13 $9\frac{1}{8}$
3 5	10 $7\frac{7}{8}$	3 8	11 $5\frac{1}{4}$	3 11	12 $2\frac{11}{16}$	4 2	13 $0\frac{1}{8}$	4 5	13 $9\frac{9}{16}$
3 $5\frac{1}{8}$	10 $8\frac{3}{16}$	3 $8\frac{1}{8}$	11 $5\frac{11}{16}$	3 $11\frac{1}{8}$	12 $3\frac{1}{16}$	4 $2\frac{1}{8}$	13 $0\frac{9}{16}$	4 $5\frac{1}{8}$	13 $9\frac{15}{16}$
3 $5\frac{1}{4}$	10 $8\frac{9}{16}$	3 $8\frac{1}{4}$	11 $6\frac{1}{16}$	3 $11\frac{1}{4}$	12 $3\frac{7}{16}$	4 $2\frac{1}{4}$	13 $0\frac{15}{16}$	4 $5\frac{1}{4}$	13 $10\frac{5}{16}$
3 $5\frac{3}{8}$	10 $8\frac{15}{16}$	3 $8\frac{3}{8}$	11 $6\frac{7}{16}$	3 $11\frac{3}{8}$	12 $3\frac{13}{16}$	4 $2\frac{3}{8}$	13 $1\frac{5}{16}$	4 $5\frac{3}{8}$	13 $10\frac{11}{16}$
3 $5\frac{1}{2}$	10 $9\frac{5}{16}$	3 $8\frac{1}{2}$	11 $6\frac{13}{16}$	3 $11\frac{1}{2}$	12 $4\frac{3}{16}$	4 $2\frac{1}{2}$	13 $1\frac{11}{16}$	4 $5\frac{1}{2}$	13 $11\frac{1}{16}$
3 $5\frac{5}{8}$	10 $9\frac{11}{16}$	3 $8\frac{5}{8}$	11 $7\frac{3}{16}$	3 $11\frac{5}{8}$	12 $4\frac{9}{16}$	4 $2\frac{5}{8}$	13 $2\frac{1}{16}$	4 $5\frac{5}{8}$	13 $11\frac{7}{16}$
3 $5\frac{3}{4}$	10 $10\frac{1}{8}$	3 $8\frac{3}{4}$	11 $7\frac{9}{16}$	3 $11\frac{3}{4}$	12 5	4 $2\frac{3}{4}$	13 $2\frac{7}{16}$	4 $5\frac{3}{4}$	13 $11\frac{7}{8}$
3 $5\frac{7}{8}$	10 $10\frac{9}{16}$	3 $8\frac{7}{8}$	11 8	3 $11\frac{7}{8}$	12 $5\frac{7}{16}$	4 $2\frac{7}{8}$	13 $2\frac{13}{16}$	4 $5\frac{7}{8}$	14 $0\frac{1}{4}$
3 6	10 11	3 9	11 $8\frac{7}{16}$	4 0	12 $5\frac{7}{8}$	4 3	13 $3\frac{1}{4}$	4 6	14 $0\frac{3}{4}$
3 $6\frac{1}{8}$	10 $11\frac{7}{16}$	3 $9\frac{1}{8}$	11 $8\frac{13}{16}$	4 $0\frac{1}{8}$	12 $6\frac{1}{4}$	4 $3\frac{1}{8}$	13 $3\frac{11}{16}$	4 $6\frac{1}{8}$	14 $1\frac{1}{8}$
3 $6\frac{1}{4}$	10 $11\frac{13}{16}$	3 $9\frac{1}{4}$	11 $9\frac{3}{16}$	4 $0\frac{1}{4}$	12 $6\frac{5}{8}$	4 $3\frac{1}{4}$	13 $4\frac{1}{16}$	4 $6\frac{1}{4}$	14 $1\frac{9}{16}$
3 $6\frac{3}{8}$	11 $0\frac{3}{16}$	3 $9\frac{3}{8}$	11 $9\frac{1}{2}$	4 $0\frac{3}{8}$	12 7	4 $3\frac{3}{8}$	13 $4\frac{7}{16}$	4 $6\frac{3}{8}$	14 $1\frac{15}{16}$
3 $6\frac{1}{2}$	11 $0\frac{9}{16}$	3 $9\frac{1}{2}$	11 $9\frac{13}{16}$	4 $0\frac{1}{2}$	12 $7\frac{3}{8}$	4 $3\frac{1}{2}$	13 $4\frac{13}{16}$	4 $6\frac{1}{2}$	14 $2\frac{5}{16}$
3 $6\frac{5}{8}$	11 $0\frac{15}{16}$	3 $9\frac{5}{8}$	11 $10\frac{3}{16}$	4 $0\frac{5}{8}$	12 $7\frac{3}{4}$	4 $3\frac{5}{8}$	13 $5\frac{3}{16}$	4 $6\frac{5}{8}$	14 $2\frac{11}{16}$
3 $6\frac{3}{4}$	11 $1\frac{3}{8}$	3 $9\frac{3}{4}$	11 $10\frac{5}{8}$	4 $0\frac{3}{4}$	12 $8\frac{1}{8}$	4 $3\frac{3}{4}$	13 $5\frac{9}{16}$	4 $6\frac{3}{4}$	14 $3\frac{1}{16}$
3 $6\frac{7}{8}$	11 $1\frac{3}{4}$	3 $9\frac{7}{8}$	11 $11\frac{1}{16}$	4 $0\frac{7}{8}$	12 $8\frac{9}{16}$	4 $3\frac{7}{8}$	13 6	4 $6\frac{7}{8}$	14 $3\frac{7}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{1}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam	Circum	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
4 7	14 $3\frac{13}{16}$	4 10	15 $1\frac{1}{4}$	5 1	15 $10\frac{11}{16}$	5 4	16 $8\frac{1}{8}$	5 7	17 $5\frac{1}{4}$
4 $7\frac{1}{8}$	14 $4\frac{1}{4}$	4 $10\frac{1}{8}$	15 $1\frac{5}{8}$	5 $1\frac{1}{8}$	15 $11\frac{1}{16}$	5 $4\frac{1}{8}$	16 $8\frac{9}{16}$	5 $7\frac{1}{8}$	17 $5\frac{7}{8}$
4 $7\frac{1}{4}$	14 $4\frac{11}{16}$	4 $10\frac{1}{4}$	15 $2\frac{1}{16}$	5 $1\frac{1}{4}$	15 $11\frac{7}{16}$	5 $4\frac{1}{4}$	16 $8\frac{15}{16}$	5 $7\frac{1}{4}$	17 $6\frac{5}{16}$
4 $7\frac{3}{8}$	14 $5\frac{1}{16}$	4 $10\frac{3}{8}$	15 $2\frac{1}{2}$	5 $1\frac{3}{8}$	15 $11\frac{13}{16}$	5 $4\frac{3}{8}$	16 $9\frac{5}{16}$	5 $7\frac{3}{8}$	17 $6\frac{11}{16}$
4 $7\frac{1}{2}$	14 $5\frac{7}{16}$	4 $10\frac{1}{2}$	15 $2\frac{7}{8}$	5 $1\frac{1}{2}$	16 $0\frac{1}{4}$	5 $4\frac{1}{2}$	16 $9\frac{11}{16}$	5 $7\frac{1}{2}$	17 $7\frac{1}{8}$
4 $7\frac{5}{8}$	14 $5\frac{13}{16}$	4 $10\frac{5}{8}$	15 $3\frac{1}{4}$	5 $1\frac{5}{8}$	16 $0\frac{5}{8}$	5 $4\frac{5}{8}$	16 $10\frac{1}{16}$	5 $7\frac{5}{8}$	17 $7\frac{9}{16}$
4 $7\frac{3}{4}$	14 $6\frac{3}{16}$	4 $10\frac{3}{4}$	15 $3\frac{5}{8}$	5 $1\frac{3}{4}$	16 $1\frac{1}{16}$	5 $4\frac{3}{4}$	16 $10\frac{7}{16}$	5 $7\frac{3}{4}$	17 $7\frac{15}{16}$
4 $7\frac{7}{8}$	14 $6\frac{5}{8}$	4 $10\frac{7}{8}$	15 4	5 $1\frac{7}{8}$	16 $1\frac{7}{16}$	5 $4\frac{7}{8}$	16 $10\frac{7}{8}$	5 $7\frac{7}{8}$	17 $8\frac{5}{16}$
4 8	14 7	4 11	15 $4\frac{3}{8}$	5 2	16 $1\frac{7}{8}$	5 5	16 $11\frac{1}{4}$	5 8	17 $8\frac{11}{16}$
4 $8\frac{1}{8}$	14 $7\frac{7}{16}$	4 $11\frac{1}{8}$	15 $4\frac{3}{4}$	5 $2\frac{1}{8}$	16 $2\frac{1}{4}$	5 $5\frac{1}{8}$	16 $11\frac{11}{16}$	5 $8\frac{1}{8}$	17 $9\frac{1}{16}$
4 $8\frac{1}{4}$	14 $7\frac{13}{16}$	4 $11\frac{1}{4}$	15 $5\frac{1}{8}$	5 $2\frac{1}{4}$	16 $2\frac{11}{16}$	5 $5\frac{1}{4}$	17 $0\frac{1}{16}$	5 $8\frac{1}{4}$	17 $9\frac{7}{16}$
4 $8\frac{3}{8}$	14 $8\frac{3}{16}$	4 $11\frac{3}{8}$	15 $5\frac{3}{16}$	5 $2\frac{3}{8}$	16 $3\frac{1}{16}$	5 $5\frac{3}{8}$	17 $0\frac{7}{16}$	5 $8\frac{3}{8}$	17 $9\frac{13}{16}$
4 $8\frac{1}{2}$	14 $8\frac{9}{16}$	4 $11\frac{1}{2}$	15 6	5 $2\frac{1}{2}$	16 $3\frac{7}{16}$	5 $5\frac{1}{2}$	17 $0\frac{13}{16}$	5 $8\frac{1}{2}$	17 $10\frac{1}{4}$
4 $8\frac{5}{8}$	14 $8\frac{15}{16}$	4 $11\frac{5}{8}$	15 $6\frac{3}{8}$	5 $2\frac{5}{8}$	16 $3\frac{13}{16}$	5 $5\frac{5}{8}$	17 $1\frac{1}{4}$	5 $8\frac{5}{8}$	17 $10\frac{11}{16}$
4 $8\frac{3}{4}$	14 $9\frac{5}{16}$	4 $11\frac{3}{4}$	15 $6\frac{3}{4}$	5 $2\frac{3}{4}$	16 $4\frac{3}{16}$	5 $5\frac{3}{4}$	17 $1\frac{5}{8}$	5 $8\frac{3}{4}$	17 $11\frac{1}{16}$
4 $8\frac{7}{8}$	14 $9\frac{11}{16}$	4 $11\frac{7}{8}$	15 $7\frac{1}{8}$	5 $2\frac{7}{8}$	16 $4\frac{5}{8}$	5 $5\frac{7}{8}$	17 2	5 $8\frac{7}{8}$	17 $11\frac{7}{16}$
4 9	14 $10\frac{1}{8}$	5 0	15 $7\frac{1}{2}$	5 3	16 5	5 6	17 $2\frac{3}{8}$	5 9	17 $11\frac{13}{16}$
4 $9\frac{1}{8}$	14 $10\frac{9}{16}$	5 $0\frac{1}{8}$	15 $7\frac{7}{8}$	5 $3\frac{1}{8}$	16 $5\frac{7}{16}$	5 $6\frac{1}{8}$	17 $2\frac{13}{16}$	5 $9\frac{1}{8}$	18 $0\frac{3}{16}$
4 $9\frac{1}{4}$	14 $10\frac{15}{16}$	5 $0\frac{1}{4}$	15 $8\frac{1}{4}$	5 $3\frac{1}{4}$	16 $5\frac{13}{16}$	5 $6\frac{1}{4}$	17 $3\frac{3}{16}$	5 $9\frac{1}{4}$	18 $0\frac{9}{16}$
4 $9\frac{3}{8}$	14 $11\frac{5}{16}$	5 $0\frac{3}{8}$	15 $8\frac{11}{16}$	5 $3\frac{3}{8}$	16 $6\frac{3}{16}$	5 $6\frac{3}{8}$	17 $3\frac{9}{16}$	5 $9\frac{3}{8}$	18 $0\frac{15}{16}$
4 $9\frac{1}{2}$	14 $11\frac{11}{16}$	5 $0\frac{1}{2}$	15 $9\frac{1}{8}$	5 $3\frac{1}{2}$	16 $6\frac{9}{16}$	5 $6\frac{1}{2}$	17 4	5 $9\frac{1}{2}$	18 $1\frac{3}{8}$
4 $9\frac{5}{8}$	15 $0\frac{1}{16}$	5 $0\frac{5}{8}$	15 $9\frac{9}{16}$	5 $3\frac{5}{8}$	16 $6\frac{15}{16}$	5 $6\frac{5}{8}$	17 $4\frac{3}{8}$	5 $9\frac{5}{8}$	18 $1\frac{13}{16}$
4 $9\frac{3}{4}$	15 $0\frac{7}{16}$	5 $0\frac{3}{4}$	15 $9\frac{15}{16}$	5 $3\frac{3}{4}$	16 $7\frac{5}{16}$	5 $6\frac{3}{4}$	17 $4\frac{3}{4}$	5 $9\frac{3}{4}$	18 $2\frac{3}{16}$
4 $9\frac{7}{8}$	15 $0\frac{13}{16}$	5 $0\frac{7}{8}$	15 $10\frac{5}{16}$	5 $3\frac{7}{8}$	16 $7\frac{3}{4}$	5 $6\frac{7}{8}$	17 $5\frac{1}{8}$	5 $9\frac{7}{8}$	18 $2\frac{9}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{5}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	10	18	3	6	1	19	$0\frac{3}{8}$	6	4	19	$9\frac{13}{16}$	6	7	20	$7\frac{1}{4}$	6	10	21	$4\frac{5}{8}$
5	$10\frac{1}{8}$	18	$3\frac{7}{16}$	6	$1\frac{1}{8}$	19	$0\frac{3}{4}$	6	$4\frac{1}{8}$	19	$10\frac{3}{16}$	6	$7\frac{1}{8}$	20	$7\frac{11}{16}$	6	$10\frac{1}{8}$	21	$5\frac{1}{16}$
5	$10\frac{1}{4}$	18	$3\frac{13}{16}$	6	$1\frac{1}{4}$	19	$1\frac{1}{8}$	6	$4\frac{1}{4}$	19	$10\frac{9}{16}$	6	$7\frac{1}{4}$	20	$8\frac{1}{16}$	6	$10\frac{1}{4}$	21	$5\frac{7}{16}$
5	$10\frac{3}{8}$	18	$4\frac{3}{16}$	6	$1\frac{3}{8}$	19	$1\frac{9}{16}$	6	$4\frac{3}{8}$	19	$10\frac{15}{16}$	6	$7\frac{3}{8}$	20	$8\frac{7}{16}$	6	$10\frac{3}{8}$	21	$5\frac{13}{16}$
5	$10\frac{1}{2}$	18	$4\frac{9}{16}$	6	$1\frac{1}{2}$	19	2	6	$4\frac{1}{2}$	19	$11\frac{3}{8}$	6	$7\frac{1}{2}$	20	$8\frac{13}{16}$	6	$10\frac{1}{2}$	21	$6\frac{3}{16}$
5	$10\frac{5}{8}$	18	$4\frac{15}{16}$	6	$1\frac{5}{8}$	19	$2\frac{3}{8}$	6	$4\frac{5}{8}$	19	$11\frac{13}{16}$	6	$7\frac{5}{8}$	20	$9\frac{3}{16}$	6	$10\frac{5}{8}$	21	$6\frac{5}{8}$
5	$10\frac{3}{4}$	18	$5\frac{7}{16}$	6	$1\frac{3}{4}$	19	$2\frac{3}{4}$	6	$4\frac{3}{4}$	20	$0\frac{3}{16}$	6	$7\frac{3}{4}$	20	$9\frac{9}{16}$	6	$10\frac{3}{4}$	21	$7\frac{1}{16}$
5	$10\frac{7}{8}$	18	$5\frac{13}{16}$	6	$1\frac{7}{8}$	19	$3\frac{1}{8}$	6	$4\frac{7}{8}$	20	$0\frac{9}{16}$	6	$7\frac{7}{8}$	20	$9\frac{15}{16}$	6	$10\frac{7}{8}$	21	$7\frac{7}{16}$
5	11	18	$6\frac{3}{16}$	6	2	19	$3\frac{1}{2}$	6	5	20	1	6	8	20	$10\frac{3}{8}$	6	11	21	$7\frac{13}{16}$
5	$11\frac{1}{8}$	18	$6\frac{9}{16}$	6	$2\frac{1}{8}$	19	$3\frac{15}{16}$	6	$5\frac{1}{8}$	20	$1\frac{3}{8}$	6	$8\frac{1}{8}$	20	$10\frac{13}{16}$	6	$11\frac{1}{8}$	21	$8\frac{3}{16}$
5	$11\frac{1}{4}$	18	$6\frac{15}{16}$	6	$2\frac{1}{4}$	19	$4\frac{5}{16}$	6	$5\frac{1}{4}$	20	$1\frac{3}{4}$	6	$8\frac{1}{4}$	20	$11\frac{3}{16}$	6	$11\frac{1}{4}$	21	$8\frac{9}{16}$
5	$11\frac{3}{8}$	18	$7\frac{5}{16}$	6	$2\frac{3}{8}$	19	$4\frac{11}{16}$	6	$5\frac{3}{8}$	20	$2\frac{1}{8}$	6	$8\frac{3}{8}$	20	$11\frac{9}{16}$	6	$11\frac{3}{8}$	21	$8\frac{15}{16}$
5	$11\frac{1}{2}$	18	$7\frac{11}{16}$	6	$2\frac{1}{2}$	19	$5\frac{1}{8}$	6	$5\frac{1}{2}$	20	$2\frac{1}{2}$	6	$8\frac{1}{2}$	20	$11\frac{15}{16}$	6	$11\frac{1}{2}$	21	$9\frac{3}{8}$
5	$11\frac{5}{8}$	18	$8\frac{1}{16}$	6	$2\frac{5}{8}$	19	$5\frac{9}{16}$	6	$5\frac{5}{8}$	20	$2\frac{15}{16}$	6	$8\frac{5}{8}$	21	$0\frac{5}{16}$	6	$11\frac{5}{8}$	21	$9\frac{13}{16}$
5	$11\frac{3}{4}$	18	$8\frac{7}{16}$	6	$2\frac{3}{4}$	19	$5\frac{15}{16}$	6	$5\frac{3}{4}$	20	$3\frac{5}{16}$	6	$8\frac{3}{4}$	21	$0\frac{11}{16}$	6	$11\frac{3}{4}$	21	$10\frac{3}{16}$
5	$11\frac{7}{8}$	18	$8\frac{13}{16}$	6	$2\frac{7}{8}$	19	$6\frac{5}{16}$	6	$5\frac{7}{8}$	20	$3\frac{11}{16}$	6	$8\frac{7}{8}$	21	$1\frac{1}{16}$	6	$11\frac{7}{8}$	21	$10\frac{9}{16}$
6	0	18	$9\frac{1}{4}$	6	3	19	$6\frac{11}{16}$	6	6	20	$4\frac{1}{8}$	6	9	21	$1\frac{1}{2}$	7	0	21	$10\frac{15}{16}$
6	$0\frac{1}{8}$	18	$9\frac{11}{16}$	6	$3\frac{1}{8}$	19	$7\frac{1}{16}$	6	$6\frac{1}{8}$	20	$4\frac{1}{2}$	6	$9\frac{1}{8}$	21	$1\frac{7}{8}$	7	$0\frac{1}{8}$	21	$11\frac{5}{16}$
6	$0\frac{1}{4}$	18	$10\frac{1}{16}$	6	$3\frac{1}{4}$	19	$7\frac{7}{16}$	6	$6\frac{1}{4}$	20	$4\frac{7}{8}$	6	$9\frac{1}{4}$	21	$2\frac{5}{16}$	7	$0\frac{1}{4}$	21	$11\frac{11}{16}$
6	$0\frac{3}{8}$	18	$10\frac{7}{16}$	6	$3\frac{3}{8}$	19	$7\frac{13}{16}$	6	$6\frac{3}{8}$	20	$5\frac{1}{4}$	6	$9\frac{3}{8}$	21	$2\frac{11}{16}$	7	$0\frac{3}{8}$	22	$0\frac{1}{16}$
6	$0\frac{1}{2}$	18	$10\frac{7}{8}$	6	$3\frac{1}{2}$	19	$8\frac{1}{4}$	6	$6\frac{1}{2}$	20	$5\frac{5}{8}$	6	$9\frac{1}{2}$	21	$3\frac{1}{8}$	7	$0\frac{1}{2}$	22	$0\frac{1}{2}$
6	$0\frac{5}{8}$	18	$11\frac{1}{4}$	6	$3\frac{5}{8}$	19	$8\frac{11}{16}$	6	$6\frac{5}{8}$	20	$6\frac{1}{16}$	6	$9\frac{5}{8}$	21	$3\frac{1}{2}$	7	$0\frac{5}{8}$	22	$0\frac{15}{16}$
6	$0\frac{3}{4}$	18	$11\frac{5}{8}$	6	$3\frac{3}{4}$	19	$9\frac{1}{16}$	6	$6\frac{3}{4}$	20	$6\frac{7}{16}$	6	$9\frac{3}{4}$	21	$3\frac{7}{8}$	7	$0\frac{3}{4}$	22	$1\frac{5}{16}$
6	$0\frac{7}{8}$	19	0	6	$3\frac{7}{8}$	19	$9\frac{7}{16}$	6	$6\frac{7}{8}$	20	$6\frac{13}{16}$	6	$9\frac{7}{8}$	21	$4\frac{1}{4}$	7	$0\frac{7}{8}$	22	$1\frac{11}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{5}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft	in	ft	in.	ft.	in.
7	1	22	$2\frac{1}{8}$	7	4	22	$11\frac{1}{2}$	7	7	23	$8\frac{15}{16}$	7	10	24	$6\frac{3}{8}$
7	$1\frac{1}{8}$	22	$2\frac{1}{2}$	7	$4\frac{1}{8}$	22	$11\frac{15}{16}$	7	$7\frac{1}{8}$	23	$9\frac{5}{16}$	7	$10\frac{1}{8}$	24	$6\frac{13}{16}$
7	$1\frac{1}{4}$	22	$2\frac{7}{8}$	7	$4\frac{1}{4}$	23	$0\frac{5}{16}$	7	$7\frac{1}{4}$	23	$9\frac{11}{16}$	7	$10\frac{1}{4}$	24	$7\frac{3}{16}$
7	$1\frac{3}{8}$	22	$3\frac{1}{4}$	7	$4\frac{3}{8}$	23	$0\frac{11}{16}$	7	$7\frac{3}{8}$	23	$10\frac{1}{8}$	7	$10\frac{3}{8}$	24	$7\frac{9}{16}$
7	$1\frac{1}{2}$	22	$3\frac{5}{8}$	7	$4\frac{1}{2}$	23	$1\frac{1}{8}$	7	$7\frac{1}{2}$	23	$10\frac{1}{2}$	7	$10\frac{1}{2}$	24	$7\frac{15}{16}$
7	$1\frac{5}{8}$	22	$4\frac{1}{16}$	7	$4\frac{5}{8}$	23	$1\frac{1}{4}$	7	$7\frac{5}{8}$	23	$10\frac{15}{16}$	7	$10\frac{5}{8}$	24	$8\frac{5}{16}$
7	$1\frac{3}{4}$	22	$4\frac{7}{16}$	7	$4\frac{3}{4}$	23	$1\frac{7}{8}$	7	$7\frac{3}{4}$	23	$11\frac{5}{16}$	7	$10\frac{3}{4}$	24	$8\frac{11}{16}$
7	$1\frac{7}{8}$	22	$4\frac{13}{16}$	7	$4\frac{7}{8}$	23	$2\frac{1}{4}$	7	$7\frac{7}{8}$	23	$11\frac{11}{16}$	7	$10\frac{7}{8}$	24	$9\frac{1}{16}$
7	2	22	$5\frac{3}{16}$	7	5	23	$2\frac{5}{8}$	7	8	24	$0\frac{1}{16}$	7	11	24	$9\frac{1}{2}$
7	$2\frac{1}{8}$	22	$5\frac{5}{8}$	7	$5\frac{1}{8}$	23	3	7	$8\frac{1}{8}$	24	$0\frac{9}{16}$	7	$11\frac{1}{8}$	24	$9\frac{15}{16}$
7	$2\frac{1}{4}$	22	6	7	$5\frac{1}{4}$	23	$3\frac{5}{16}$	7	$8\frac{1}{4}$	24	$0\frac{7}{8}$	7	$11\frac{1}{4}$	24	$10\frac{5}{16}$
7	$2\frac{3}{8}$	22	$6\frac{7}{16}$	7	$5\frac{3}{8}$	23	$3\frac{11}{16}$	7	$8\frac{3}{8}$	24	$1\frac{3}{16}$	7	$11\frac{3}{8}$	24	$10\frac{11}{16}$
7	$2\frac{1}{2}$	22	$6\frac{13}{16}$	7	$5\frac{1}{2}$	23	$4\frac{3}{16}$	7	$8\frac{1}{2}$	24	$1\frac{5}{8}$	7	$11\frac{1}{2}$	24	$11\frac{1}{16}$
7	$2\frac{5}{8}$	22	$7\frac{1}{4}$	7	$5\frac{5}{8}$	23	$4\frac{5}{8}$	7	$8\frac{5}{8}$	24	$2\frac{1}{16}$	7	$11\frac{5}{8}$	24	$11\frac{7}{16}$
7	$2\frac{3}{4}$	22	$7\frac{5}{8}$	7	$5\frac{3}{4}$	23	$5\frac{1}{16}$	7	$8\frac{3}{4}$	24	$2\frac{7}{16}$	7	$11\frac{3}{4}$	24	$11\frac{13}{16}$
7	$2\frac{7}{8}$	22	8	7	$5\frac{7}{8}$	23	$5\frac{7}{16}$	7	$8\frac{7}{8}$	24	$2\frac{13}{16}$	7	$11\frac{7}{8}$	25	$0\frac{1}{4}$
7	3	22	$8\frac{3}{8}$	7	6	23	$5\frac{13}{16}$	7	9	24	$3\frac{1}{4}$	8	0	25	$0\frac{5}{8}$
7	$3\frac{1}{8}$	22	$8\frac{11}{16}$	7	$6\frac{1}{8}$	23	$6\frac{3}{16}$	7	$9\frac{1}{8}$	24	$3\frac{5}{8}$	8	$0\frac{1}{8}$	25	$1\frac{1}{16}$
7	$3\frac{1}{4}$	22	$9\frac{1}{16}$	7	$6\frac{1}{4}$	23	$6\frac{9}{16}$	7	$9\frac{1}{4}$	24	4	8	$0\frac{1}{4}$	25	$1\frac{7}{16}$
7	$3\frac{3}{8}$	22	$9\frac{1}{2}$	7	$6\frac{3}{8}$	23	$6\frac{15}{16}$	7	$9\frac{3}{8}$	24	$4\frac{3}{8}$	8	$0\frac{3}{8}$	25	$1\frac{13}{16}$
7	$3\frac{1}{2}$	22	$9\frac{15}{16}$	7	$6\frac{1}{2}$	23	$7\frac{3}{8}$	7	$9\frac{1}{2}$	24	$4\frac{3}{4}$	8	$0\frac{1}{2}$	25	$2\frac{1}{4}$
7	$3\frac{5}{8}$	22	$10\frac{5}{16}$	7	$6\frac{5}{8}$	23	$7\frac{13}{16}$	7	$9\frac{5}{8}$	24	$5\frac{1}{16}$	8	$0\frac{5}{8}$	25	$2\frac{5}{8}$
7	$3\frac{3}{4}$	22	$10\frac{11}{16}$	7	$6\frac{3}{4}$	23	$8\frac{3}{16}$	7	$9\frac{3}{4}$	24	$5\frac{1}{2}$	8	$0\frac{3}{4}$	25	3
7	$3\frac{7}{8}$	22	$11\frac{1}{16}$	7	$6\frac{7}{8}$	23	$8\frac{9}{16}$	7	$9\frac{7}{8}$	24	$5\frac{15}{16}$	8	$0\frac{7}{8}$	25	$3\frac{3}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ⅜ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
0	10	2	6 5/16	1	1	3	3 3/8	1	4	4	1 1/8	1	7	4	10 9/16	1	10	5	8 1/16
0	10 1/8	2	6 11/16	1	1 1/8	3	4 1/16	1	4 1/8	4	1 1/2	1	7 1/8	4	10 15/16	1	10 1/8	5	8 7/16
0	10 1/4	2	7 1/16	1	1 1/4	3	4 1/2	1	4 1/4	4	1 15/16	1	7 1/4	4	11 5/16	1	10 1/4	5	8 15/16
0	10 3/8	2	7 1/2	1	1 3/8	3	4 7/8	1	4 3/8	4	2 1/4	1	7 3/8	4	11 11/16	1	10 3/8	5	9 5/16
0	10 1/2	2	7 15/16	1	1 1/2	3	5 1/4	1	4 1/2	4	2 11/16	1	7 1/2	5	0 1/8	1	10 1/2	5	9 3/4
0	10 5/8	2	8 1/4	1	1 5/8	3	5 5/8	1	4 5/8	4	3	1	7 5/8	5	0 1/2	1	10 5/8	5	10 1/8
0	10 3/4	2	8 5/8	1	1 3/4	3	6	1	4 3/4	4	3 3/8	1	7 3/4	5	0 7/8	1	10 3/4	5	10 1/2
0	10 7/8	2	9	1	1 7/8	3	6 3/8	1	4 7/8	4	3 3/4	1	7 7/8	5	1 5/16	1	10 7/8	5	10 7/8
0	11	2	9 3/8	1	2	3	6 13/16	1	5	4	4 1/4	1	8	5	1 11/16	1	11	5	11 5/16
0	11 1/8	2	9 3/4	1	2 1/8	3	7 1/8	1	5 1/8	4	4 5/8	1	8 1/8	5	2	1	11 1/8	5	11 11/16
0	11 1/4	2	10 3/16	1	2 1/4	3	7 5/8	1	5 1/4	4	5	1	8 1/4	5	2 7/16	1	11 1/4	6	0 1/8
0	11 3/8	2	10 5/8	1	2 3/8	3	8	1	5 3/8	4	5 3/8	1	8 3/8	5	2 13/16	1	11 3/8	6	0 1/2
0	11 1/2	2	11	1	2 1/2	3	8 3/8	1	5 1/2	4	5 3/4	1	8 1/2	5	3 1/4	1	11 1/2	6	0 13/16
0	11 5/8	2	11 3/8	1	2 5/8	3	8 7/8	1	5 5/8	4	6 1/8	1	8 5/8	5	3 11/16	1	11 5/8	6	1 3/16
0	11 3/4	2	11 13/16	1	2 3/4	3	9 1/4	1	5 3/4	4	6 11/16	1	8 3/4	5	4 1/16	1	11 3/4	6	1 9/16
0	11 7/8	3	0 1/8	1	2 7/8	3	9 5/8	1	5 7/8	4	7	1	8 7/8	5	4 7/16	1	11 7/8	6	1 15/16
1	0	3	0 9/16	1	3	3	10	1	6	4	7 7/16	1	9	5	4 13/16	2	0	6	2 3/8
1	0 1/8	3	0 7/8	1	3 1/8	3	10 3/8	1	6 1/8	4	7 13/16	1	9 1/8	5	5 3/16	2	0 1/8	6	2 3/4
1	0 1/4	3	1 1/4	1	3 1/4	3	10 3/4	1	6 1/4	4	8 3/16	1	9 1/4	5	5 5/8	2	0 1/4	6	3 3/16
1	0 3/8	3	1 3/4	1	3 3/8	3	11 3/16	1	6 3/8	4	8 1/2	1	9 3/8	5	6	2	0 3/8	6	3 9/16
1	0 1/2	3	2 1/8	1	3 1/2	3	11 9/16	1	6 1/2	4	8 15/16	1	9 1/2	5	6 3/8	2	0 1/2	6	3 15/16
1	0 5/8	3	2 1/2	1	3 5/8	3	11 15/16	1	6 5/8	4	9 3/8	1	9 5/8	5	6 3/4	2	0 5/8	6	4 3/8
1	0 3/4	3	2 7/8	1	3 3/4	4	0 3/16	1	6 3/4	4	9 3/4	1	9 3/4	5	7 3/16	2	0 3/4	6	4 3/4
1	0 7/8	3	3 1/4	1	3 7/8	4	0 11/16	1	6 7/8	4	10 1/8	1	9 7/8	5	7 9/16	2	0 7/8	6	5 1/8

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 $5\frac{1}{2}$	2 4	7 $2\frac{13}{16}$	2 7	8 $0\frac{5}{16}$	2 10	8 $9\frac{11}{16}$	3 1	9 $7\frac{1}{8}$
2 $1\frac{1}{8}$	6 $5\frac{7}{8}$	2 $4\frac{1}{8}$	7 $3\frac{1}{8}$	2 $7\frac{1}{8}$	8 $0\frac{11}{16}$	2 $10\frac{1}{8}$	8 $10\frac{1}{16}$	3 $1\frac{1}{8}$	9 $7\frac{1}{2}$
2 $1\frac{1}{4}$	6 $6\frac{1}{4}$	2 $4\frac{1}{4}$	7 $3\frac{1}{2}$	2 $7\frac{1}{4}$	8 $1\frac{1}{16}$	2 $10\frac{1}{4}$	8 $10\frac{7}{16}$	3 $1\frac{1}{4}$	9 $7\frac{7}{8}$
2 $1\frac{3}{8}$	6 $6\frac{5}{8}$	2 $4\frac{3}{8}$	7 $3\frac{7}{8}$	2 $7\frac{3}{8}$	8 $1\frac{7}{16}$	2 $10\frac{3}{8}$	8 $10\frac{13}{16}$	3 $1\frac{3}{8}$	9 $8\frac{1}{4}$
2 $1\frac{1}{2}$	6 7	2 $4\frac{1}{2}$	7 $4\frac{3}{8}$	2 $7\frac{1}{2}$	8 $1\frac{13}{16}$	2 $10\frac{1}{2}$	8 $11\frac{1}{4}$	3 $1\frac{1}{2}$	9 $8\frac{11}{16}$
2 $1\frac{5}{8}$	6 $7\frac{3}{8}$	2 $4\frac{5}{8}$	7 $4\frac{3}{4}$	2 $7\frac{5}{8}$	8 $2\frac{3}{16}$	2 $10\frac{5}{8}$	8 $11\frac{5}{8}$	3 $1\frac{5}{8}$	9 $9\frac{1}{16}$
2 $1\frac{3}{4}$	6 $7\frac{3}{4}$	2 $4\frac{3}{4}$	7 $5\frac{1}{8}$	2 $7\frac{3}{4}$	8 $2\frac{9}{16}$	2 $10\frac{3}{4}$	9 0	3 $1\frac{3}{4}$	9 $9\frac{7}{16}$
2 $1\frac{7}{8}$	6 $8\frac{1}{8}$	2 $4\frac{7}{8}$	7 $5\frac{1}{2}$	2 $7\frac{7}{8}$	8 3	2 $10\frac{7}{8}$	9 $0\frac{3}{8}$	3 $1\frac{7}{8}$	9 $9\frac{13}{16}$
2 2	6 $8\frac{1}{2}$	2 5	7 $5\frac{7}{8}$	2 8	8 $3\frac{3}{8}$	2 11	9 $0\frac{13}{16}$	3 2	9 $10\frac{3}{16}$
2 $2\frac{1}{8}$	6 $8\frac{7}{8}$	2 $5\frac{1}{8}$	7 $6\frac{1}{4}$	2 $8\frac{1}{8}$	8 $3\frac{3}{4}$	2 $11\frac{1}{8}$	9 $1\frac{1}{8}$	3 $2\frac{1}{8}$	9 $10\frac{5}{8}$
2 $2\frac{1}{4}$	6 $9\frac{1}{4}$	2 $5\frac{1}{4}$	7 $6\frac{5}{8}$	2 $8\frac{1}{4}$	8 $4\frac{1}{8}$	2 $11\frac{1}{4}$	9 $1\frac{9}{16}$	3 $2\frac{1}{4}$	9 $11\frac{1}{16}$
2 $2\frac{3}{8}$	6 $9\frac{11}{16}$	2 $5\frac{3}{8}$	7 7	2 $8\frac{3}{8}$	8 $4\frac{1}{2}$	2 $11\frac{3}{8}$	9 2	3 $2\frac{3}{8}$	9 $11\frac{1}{2}$
2 $2\frac{1}{2}$	6 $10\frac{1}{8}$	2 $5\frac{1}{2}$	7 $7\frac{3}{8}$	2 $8\frac{1}{2}$	8 $4\frac{15}{16}$	2 $11\frac{1}{2}$	9 $2\frac{3}{8}$	3 $2\frac{1}{2}$	9 $11\frac{7}{8}$
2 $2\frac{5}{8}$	6 $10\frac{1}{2}$	2 $5\frac{5}{8}$	7 $7\frac{3}{4}$	2 $8\frac{5}{8}$	8 $5\frac{5}{16}$	2 $11\frac{5}{8}$	9 $2\frac{3}{4}$	3 $2\frac{5}{8}$	10 $0\frac{1}{4}$
2 $2\frac{3}{4}$	6 $10\frac{15}{16}$	2 $5\frac{3}{4}$	7 $8\frac{3}{16}$	2 $8\frac{3}{4}$	8 $5\frac{11}{16}$	2 $11\frac{3}{4}$	9 $3\frac{1}{8}$	3 $2\frac{3}{4}$	10 $0\frac{5}{8}$
2 $2\frac{7}{8}$	6 $11\frac{5}{16}$	2 $5\frac{7}{8}$	7 $8\frac{5}{8}$	2 $8\frac{7}{8}$	8 $6\frac{1}{16}$	2 $11\frac{7}{8}$	9 $3\frac{1}{2}$	3 $2\frac{7}{8}$	10 1
2 3	6 $11\frac{11}{16}$	2 6	7 $9\frac{1}{16}$	2 9	8 $6\frac{7}{16}$	3 0	9 $3\frac{7}{8}$	3 3	10 $1\frac{3}{8}$
2 $3\frac{1}{8}$	7 0	2 $6\frac{1}{8}$	7 $9\frac{1}{2}$	2 $9\frac{1}{8}$	8 $6\frac{7}{8}$	3 $0\frac{1}{8}$	9 $4\frac{5}{16}$	3 $3\frac{1}{8}$	10 $1\frac{3}{4}$
2 $3\frac{1}{4}$	7 $0\frac{7}{16}$	2 $6\frac{1}{4}$	7 $9\frac{7}{8}$	2 $9\frac{1}{4}$	8 $7\frac{5}{16}$	3 $0\frac{1}{4}$	9 $4\frac{11}{16}$	3 $3\frac{1}{4}$	10 $2\frac{3}{16}$
2 $3\frac{3}{8}$	7 $0\frac{13}{16}$	2 $6\frac{3}{8}$	7 $10\frac{1}{4}$	2 $9\frac{3}{8}$	8 $7\frac{11}{16}$	3 $0\frac{3}{8}$	9 $5\frac{1}{16}$	3 $3\frac{3}{8}$	10 $2\frac{9}{16}$
2 $3\frac{1}{2}$	7 $1\frac{5}{16}$	2 $6\frac{1}{2}$	7 $10\frac{11}{16}$	2 $9\frac{1}{2}$	8 $8\frac{1}{16}$	3 $0\frac{1}{2}$	9 $5\frac{1}{2}$	3 $3\frac{1}{2}$	10 $2\frac{15}{16}$
2 $3\frac{5}{8}$	7 $1\frac{11}{16}$	2 $6\frac{5}{8}$	7 $11\frac{1}{16}$	2 $9\frac{5}{8}$	8 $8\frac{7}{16}$	3 $0\frac{5}{8}$	9 $5\frac{15}{16}$	3 $3\frac{5}{8}$	10 $3\frac{5}{16}$
2 $3\frac{3}{4}$	7 $2\frac{1}{16}$	2 $6\frac{3}{4}$	7 $11\frac{7}{16}$	2 $9\frac{3}{4}$	8 $8\frac{7}{8}$	3 $0\frac{3}{4}$	9 $6\frac{5}{16}$	3 $3\frac{3}{4}$	10 $3\frac{3}{4}$
2 $3\frac{7}{8}$	7 $2\frac{7}{16}$	2 $6\frac{7}{8}$	7 $11\frac{13}{16}$	2 $9\frac{7}{8}$	8 $9\frac{5}{16}$	3 $0\frac{7}{8}$	9 $6\frac{3}{4}$	3 $3\frac{7}{8}$	10 $4\frac{1}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{5}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 4	10 $4\frac{1}{2}$	3 7	11 $1\frac{15}{16}$	3 10	11 $11\frac{5}{16}$	4 1	12 $8\frac{3}{4}$	4 4	13 $6\frac{3}{16}$
3 $4\frac{1}{8}$	10 $4\frac{7}{8}$	3 $7\frac{1}{8}$	11 $2\frac{3}{8}$	3 $10\frac{1}{8}$	11 $11\frac{3}{4}$	4 $1\frac{1}{8}$	12 $9\frac{3}{16}$	4 $4\frac{1}{8}$	13 $6\frac{9}{16}$
3 $4\frac{1}{4}$	10 $5\frac{5}{16}$	3 $7\frac{1}{4}$	11 $2\frac{3}{4}$	3 $10\frac{1}{4}$	12 $0\frac{1}{8}$	4 $1\frac{1}{4}$	12 $9\frac{5}{8}$	4 $4\frac{1}{4}$	13 $6\frac{15}{16}$
3 $4\frac{3}{8}$	10 $5\frac{3}{4}$	3 $7\frac{3}{8}$	11 $3\frac{1}{8}$	3 $10\frac{3}{8}$	12 $0\frac{1}{2}$	4 $1\frac{3}{8}$	12 10	4 $4\frac{3}{8}$	13 $7\frac{3}{8}$
3 $4\frac{1}{2}$	10 $6\frac{1}{8}$	3 $7\frac{1}{2}$	11 $3\frac{1}{2}$	3 $10\frac{1}{2}$	12 $0\frac{7}{8}$	4 $1\frac{1}{2}$	12 $10\frac{7}{16}$	4 $4\frac{1}{2}$	13 $7\frac{3}{4}$
3 $4\frac{5}{8}$	10 $6\frac{1}{2}$	3 $7\frac{5}{8}$	11 $3\frac{7}{8}$	3 $10\frac{5}{8}$	12 $1\frac{1}{4}$	4 $1\frac{5}{8}$	12 $10\frac{13}{16}$	4 $4\frac{5}{8}$	13 $8\frac{3}{16}$
3 $4\frac{3}{4}$	10 $6\frac{7}{8}$	3 $7\frac{3}{4}$	11 $4\frac{1}{4}$	3 $10\frac{3}{4}$	12 $1\frac{5}{8}$	4 $1\frac{3}{4}$	12 $11\frac{1}{8}$	4 $4\frac{3}{4}$	13 $8\frac{1}{2}$
3 $4\frac{7}{8}$	10 $7\frac{5}{16}$	3 $7\frac{7}{8}$	11 $4\frac{5}{8}$	3 $10\frac{7}{8}$	12 $2\frac{1}{16}$	4 $1\frac{7}{8}$	12 $11\frac{1}{2}$	4 $4\frac{7}{8}$	13 $8\frac{7}{8}$
3 5	10 $7\frac{3}{4}$	3 8	11 $5\frac{1}{16}$	3 11	12 $2\frac{1}{2}$	4 2	12 $11\frac{7}{8}$	4 5	13 $9\frac{5}{16}$
3 $5\frac{1}{8}$	10 $8\frac{1}{8}$	3 $8\frac{1}{8}$	11 $5\frac{1}{2}$	3 $11\frac{1}{8}$	12 $2\frac{7}{8}$	4 $2\frac{1}{8}$	13 $0\frac{5}{16}$	4 $5\frac{1}{8}$	13 $9\frac{3}{4}$
3 $5\frac{1}{4}$	10 $8\frac{1}{2}$	3 $8\frac{1}{4}$	11 $5\frac{7}{8}$	3 $11\frac{1}{4}$	12 $3\frac{1}{4}$	4 $2\frac{1}{4}$	13 $0\frac{3}{4}$	4 $5\frac{1}{4}$	13 $10\frac{1}{8}$
3 $5\frac{3}{8}$	10 $8\frac{7}{8}$	3 $8\frac{3}{8}$	11 $6\frac{1}{4}$	3 $11\frac{3}{8}$	12 $3\frac{5}{8}$	4 $2\frac{3}{8}$	13 $1\frac{1}{8}$	4 $5\frac{3}{8}$	13 $10\frac{1}{2}$
3 $5\frac{1}{2}$	10 $9\frac{1}{4}$	3 $8\frac{1}{2}$	11 $6\frac{5}{8}$	3 $11\frac{1}{2}$	12 4	4 $2\frac{1}{2}$	13 $1\frac{1}{2}$	4 $5\frac{1}{2}$	13 $10\frac{7}{8}$
3 $5\frac{5}{8}$	10 $9\frac{5}{8}$	3 $8\frac{5}{8}$	11 7	3 $11\frac{5}{8}$	12 $4\frac{3}{8}$	4 $2\frac{5}{8}$	13 $1\frac{7}{8}$	4 $5\frac{5}{8}$	13 $11\frac{1}{4}$
3 $5\frac{3}{4}$	10 10	3 $8\frac{3}{4}$	11 $7\frac{3}{8}$	3 $11\frac{3}{4}$	12 $4\frac{13}{16}$	4 $2\frac{3}{4}$	13 $2\frac{1}{4}$	4 $5\frac{3}{4}$	13 $11\frac{11}{16}$
3 $5\frac{7}{8}$	10 $10\frac{3}{8}$	3 $8\frac{7}{8}$	11 $7\frac{13}{16}$	3 $11\frac{7}{8}$	12 $5\frac{1}{4}$	4 $2\frac{7}{8}$	13 $2\frac{5}{8}$	4 $5\frac{7}{8}$	14 $0\frac{1}{16}$
3 6	10 $10\frac{3}{4}$	3 9	11 $8\frac{1}{4}$	4 0	12 $5\frac{11}{16}$	4 3	13 $3\frac{1}{16}$	4 6	14 $0\frac{1}{2}$
3 $6\frac{1}{8}$	10 $11\frac{3}{16}$	3 $9\frac{1}{8}$	11 $8\frac{5}{8}$	4 $0\frac{1}{8}$	12 $6\frac{1}{16}$	4 $3\frac{1}{8}$	13 $3\frac{1}{2}$	4 $6\frac{1}{8}$	14 $0\frac{15}{16}$
3 $6\frac{1}{4}$	10 $11\frac{5}{8}$	3 $9\frac{1}{4}$	11 9	4 $0\frac{1}{4}$	12 $6\frac{7}{16}$	4 $3\frac{1}{4}$	13 $3\frac{7}{8}$	4 $6\frac{1}{4}$	14 $1\frac{3}{8}$
3 $6\frac{3}{8}$	11 0	3 $9\frac{3}{8}$	11 $9\frac{3}{8}$	4 $0\frac{3}{8}$	12 $6\frac{13}{16}$	4 $3\frac{3}{8}$	13 $4\frac{1}{4}$	4 $6\frac{3}{8}$	14 $1\frac{3}{4}$
3 $6\frac{1}{2}$	11 $0\frac{3}{8}$	3 $9\frac{1}{2}$	11 $9\frac{3}{4}$	4 $0\frac{1}{2}$	12 $7\frac{1}{8}$	4 $3\frac{1}{2}$	13 $4\frac{5}{8}$	4 $6\frac{1}{2}$	14 $2\frac{1}{8}$
3 $6\frac{5}{8}$	11 $0\frac{3}{4}$	3 $9\frac{5}{8}$	11 $10\frac{1}{8}$	4 $0\frac{5}{8}$	12 $7\frac{1}{2}$	4 $3\frac{5}{8}$	13 5	4 $6\frac{5}{8}$	14 $2\frac{1}{2}$
3 $6\frac{3}{4}$	11 $1\frac{3}{16}$	3 $9\frac{3}{4}$	11 $10\frac{1}{2}$	4 $0\frac{3}{4}$	12 $7\frac{7}{8}$	4 $3\frac{3}{4}$	13 $5\frac{3}{8}$	4 $6\frac{3}{4}$	14 $2\frac{7}{8}$
3 $6\frac{7}{8}$	11 $1\frac{9}{16}$	3 $9\frac{7}{8}$	11 $10\frac{7}{8}$	4 $0\frac{7}{8}$	12 $8\frac{5}{16}$	4 $3\frac{7}{8}$	13 $5\frac{3}{4}$	4 $6\frac{7}{8}$	14 $3\frac{1}{4}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ⅜ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft in.	ft. in.	ft. in.	ft. in.
4 7	14 3⅝	4 10	15 1 1/16	5 1	15 10½	5 4	16 7 15/16	5 7	17 5 5/16
4 7⅛	14 4 1/16	4 10⅛	15 1 7/16	5 1⅛	15 10⅞	5 4⅛	16 8⅜	5 7⅛	17 5 11/16
4 7¼	14 4½	4 10¼	15 1⅞	5 1¼	15 11¼	5 4¼	16 8¾	5 7¼	17 6⅛
4 7⅜	14 4⅞	4 10⅜	15 2¼	5 1⅜	15 11⅝	5 4⅜	16 9⅛	5 7⅜	17 6½
4 7½	14 5¼	4 10½	15 2 11/16	5 1½	16 0 1/16	5 4½	16 9½	5 7½	17 6 5/16
4 7⅝	14 5⅝	4 10⅝	15 3 1/16	5 1⅝	16 0 7/16	5 4⅝	16 9⅞	5 7⅝	17 7⅜
4 7¾	14 6	4 10¾	15 3 7/16	5 1¾	16 0⅞	5 4¾	16 10¼	5 7¾	17 7¾
4 7⅞	14 6 7/16	4 10⅞	15 3 13/16	5 1⅞	16 1¼	5 4⅞	16 10 11/16	5 7⅞	17 8⅛
4 8	14 6 13/16	4 11	15 4 3/16	5 2	16 1 11/16	5 5	16 11 1/16	5 8	17 8½
4 8⅛	14 7 5/16	4 11⅛	15 4 9/16	5 2⅛	16 2 1/16	5 5⅛	16 11½	5 8⅛	17 8⅞
4 8¼	14 7 11/16	4 11¼	15 4 15/16	5 2¼	16 2½	5 5¼	16 11⅞	5 8¼	17 9¼
4 8⅜	14 8 1/16	4 11⅜	15 5⅜	5 2⅜	16 2⅞	5 5⅜	17 0¼	5 8⅜	17 9⅝
4 8½	14 8 7/16	4 11½	15 5¾	5 2½	16 3¼	5 5½	17 0⅝	5 8½	17 10 1/16
4 8⅝	14 8 13/16	4 11⅝	15 6 3/16	5 2⅝	16 3⅝	5 5⅝	17 1 1/16	5 8⅝	17 10½
4 8¾	14 9 3/16	4 11¾	15 6 9/16	5 2¾	16 4	5 5¾	17 1 7/16	5 8¾	17 10⅞
4 8⅞	14 9 9/16	4 11⅞	15 6 15/16	5 2⅞	16 4 7/16	5 5⅞	17 1 13/16	5 8⅞	17 11¼
4 9	14 9 15/16	5 0	15 7 5/16	5 3	16 4 13/16	5 6	17 2 3/16	5 9	17 11⅝
4 9⅛	14 10⅜	5 0⅛	15 7 11/16	5 3⅛	16 5¼	5 6⅛	17 2⅝	5 9⅛	18 0
4 9¼	14 10¾	5 0¼	15 8 1/16	5 3¼	16 5⅝	5 6¼	17 3	5 9¼	18 0⅜
4 9⅜	14 11⅛	5 0⅜	15 8½	5 3⅜	16 6	5 6⅜	17 3⅜	5 9⅜	18 0¾
4 9½	14 11½	5 0½	15 8 15/16	5 3½	16 6⅜	5 6½	17 3 13/16	5 9½	18 1 3/16
4 9⅝	14 11⅞	5 0⅝	15 9⅜	5 3⅝	16 6¾	5 6⅝	17 4 3/16	5 9⅝	18 1⅝
4 9¾	15 0¼	5 0¾	15 9¾	5 3¾	16 7⅛	5 6¾	17 4 9/16	5 9¾	18 2
4 9⅞	15 0⅝	5 0⅞	15 10⅛	5 3⅞	16 7½	5 6⅞	17 4 15/16	5 9⅞	18 2⅜

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
5 10	18 $2\frac{13}{16}$	6 1	19 $0\frac{3}{16}$	6 4	19 $9\frac{5}{8}$	6 7	20 $7\frac{1}{16}$	6 10	21 $4\frac{7}{16}$
5 $10\frac{1}{8}$	18 $3\frac{1}{4}$	6 $1\frac{1}{8}$	19 $0\frac{9}{16}$	6 $4\frac{1}{8}$	19 10	6 $7\frac{1}{8}$	20 $7\frac{1}{2}$	6 $10\frac{1}{8}$	21 $4\frac{7}{8}$
5 $10\frac{1}{4}$	18 $3\frac{5}{8}$	6 $1\frac{1}{4}$	19 1	6 $4\frac{1}{4}$	19 $10\frac{3}{8}$	6 $7\frac{1}{4}$	20 $7\frac{7}{8}$	6 $10\frac{1}{4}$	21 $5\frac{1}{4}$
5 $10\frac{3}{8}$	18 4	6 $1\frac{3}{8}$	19 $1\frac{7}{16}$	6 $4\frac{3}{8}$	19 $10\frac{3}{4}$	6 $7\frac{3}{8}$	20 $8\frac{1}{4}$	6 $10\frac{3}{8}$	21 $5\frac{5}{8}$
5 $10\frac{1}{2}$	18 $4\frac{3}{8}$	6 $1\frac{1}{2}$	19 $1\frac{13}{16}$	6 $4\frac{1}{2}$	19 $11\frac{3}{16}$	6 $7\frac{1}{2}$	20 $8\frac{5}{8}$	6 $10\frac{1}{2}$	21 6
5 $10\frac{5}{8}$	18 $4\frac{3}{4}$	6 $1\frac{5}{8}$	19 $2\frac{3}{16}$	6 $4\frac{5}{8}$	19 $11\frac{5}{8}$	6 $7\frac{5}{8}$	20 9	6 $10\frac{5}{8}$	21 $6\frac{7}{16}$
5 $10\frac{3}{4}$	18 $5\frac{3}{16}$	6 $1\frac{3}{4}$	19 $2\frac{9}{16}$	6 $4\frac{3}{4}$	20 0	6 $7\frac{3}{4}$	20 $9\frac{3}{8}$	6 $10\frac{3}{4}$	21 $6\frac{7}{8}$
5 $10\frac{7}{8}$	18 $5\frac{5}{8}$	6 $1\frac{7}{8}$	19 $2\frac{15}{16}$	6 $4\frac{7}{8}$	20 $0\frac{3}{8}$	6 $7\frac{7}{8}$	20 $9\frac{13}{16}$	6 $10\frac{7}{8}$	21 $7\frac{1}{4}$
5 11	18 6	6 2	19 $3\frac{5}{16}$	6 5	20 $0\frac{13}{16}$	6 8	20 $10\frac{3}{16}$	6 11	21 $7\frac{5}{8}$
5 $11\frac{1}{8}$	18 $6\frac{3}{8}$	6 $2\frac{1}{8}$	19 $3\frac{3}{4}$	6 $5\frac{1}{8}$	20 $1\frac{3}{16}$	6 $8\frac{1}{8}$	20 $10\frac{5}{8}$	6 $11\frac{1}{8}$	21 8
5 $11\frac{1}{4}$	18 $6\frac{3}{4}$	6 $2\frac{1}{4}$	19 $4\frac{1}{8}$	6 $5\frac{1}{4}$	20 $1\frac{9}{16}$	6 $8\frac{1}{4}$	20 11	6 $11\frac{1}{4}$	21 $8\frac{3}{8}$
5 $11\frac{3}{8}$	18 $7\frac{1}{8}$	6 $2\frac{3}{8}$	19 $4\frac{1}{2}$	6 $5\frac{3}{8}$	20 $1\frac{15}{16}$	6 $8\frac{3}{8}$	20 $11\frac{3}{8}$	6 $11\frac{3}{8}$	21 $8\frac{3}{4}$
5 $11\frac{1}{2}$	18 $7\frac{1}{2}$	6 $2\frac{1}{2}$	19 $4\frac{15}{16}$	6 $5\frac{1}{2}$	20 $2\frac{5}{16}$	6 $8\frac{1}{2}$	20 $11\frac{3}{4}$	6 $11\frac{1}{2}$	21 $9\frac{3}{16}$
5 $11\frac{5}{8}$	18 $7\frac{7}{8}$	6 $2\frac{5}{8}$	19 $5\frac{3}{8}$	6 $5\frac{5}{8}$	20 $2\frac{3}{4}$	6 $8\frac{5}{8}$	21 $0\frac{1}{8}$	6 $11\frac{5}{8}$	21 $9\frac{5}{8}$
5 $11\frac{3}{4}$	18 $8\frac{1}{4}$	6 $2\frac{3}{4}$	19 $5\frac{3}{4}$	6 $5\frac{3}{4}$	20 $3\frac{1}{8}$	6 $8\frac{3}{4}$	21 $0\frac{1}{2}$	6 $11\frac{3}{4}$	21 10
5 $11\frac{7}{8}$	18 $8\frac{5}{8}$	6 $2\frac{7}{8}$	19 $6\frac{1}{8}$	6 $5\frac{7}{8}$	20 $3\frac{1}{2}$	6 $8\frac{7}{8}$	21 $0\frac{7}{8}$	6 $11\frac{7}{8}$	21 $10\frac{3}{8}$
6 0	18 $9\frac{1}{16}$	6 3	19 $6\frac{1}{2}$	6 6	20 $3\frac{7}{8}$	6 9	21 $1\frac{5}{16}$	7 0	21 $10\frac{3}{4}$
6 $0\frac{1}{8}$	18 $9\frac{1}{2}$	6 $3\frac{1}{8}$	19 $6\frac{7}{8}$	6 $6\frac{1}{8}$	20 $4\frac{5}{16}$	6 $9\frac{1}{8}$	21 $1\frac{11}{16}$	7 $0\frac{1}{8}$	21 $11\frac{1}{8}$
6 $0\frac{1}{4}$	18 $9\frac{7}{8}$	6 $3\frac{1}{4}$	19 $7\frac{1}{4}$	6 $6\frac{1}{4}$	20 $4\frac{11}{16}$	6 $9\frac{1}{4}$	21 $2\frac{1}{8}$	7 $0\frac{1}{4}$	21 $11\frac{1}{2}$
6 $0\frac{3}{8}$	18 $10\frac{1}{4}$	6 $3\frac{3}{8}$	19 $7\frac{5}{8}$	6 $6\frac{3}{8}$	20 $5\frac{1}{16}$	6 $9\frac{3}{8}$	21 $2\frac{1}{2}$	7 $0\frac{3}{8}$	21 $11\frac{7}{8}$
6 $0\frac{1}{2}$	18 $10\frac{5}{8}$	6 $3\frac{1}{2}$	19 $8\frac{1}{16}$	6 $6\frac{1}{2}$	20 $5\frac{7}{16}$	6 $9\frac{1}{2}$	21 $2\frac{7}{8}$	7 $0\frac{1}{2}$	22 $0\frac{5}{16}$
6 $0\frac{5}{8}$	18 $11\frac{1}{16}$	6 $3\frac{5}{8}$	19 $8\frac{1}{2}$	6 $6\frac{5}{8}$	20 $5\frac{7}{8}$	6 $9\frac{5}{8}$	21 $3\frac{5}{16}$	7 $0\frac{5}{8}$	22 $0\frac{3}{4}$
6 $0\frac{3}{4}$	18 $11\frac{7}{16}$	6 $3\frac{3}{4}$	19 $8\frac{7}{8}$	6 $6\frac{3}{4}$	20 $6\frac{1}{4}$	6 $9\frac{3}{4}$	21 $3\frac{11}{16}$	7 $0\frac{3}{4}$	22 $1\frac{1}{8}$
6 $0\frac{7}{8}$	18 $11\frac{13}{16}$	6 $3\frac{7}{8}$	19 $9\frac{1}{4}$	6 $6\frac{7}{8}$	20 $6\frac{5}{8}$	6 $9\frac{7}{8}$	21 $4\frac{1}{16}$	7 $0\frac{7}{8}$	22 $1\frac{1}{2}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{3}{8}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	1	22	$1\frac{5}{16}$	7	4	22	$11\frac{5}{16}$	7	7	23	$8\frac{3}{4}$	7	10	24	$6\frac{3}{16}$
7	$1\frac{1}{8}$	22	$2\frac{5}{16}$	7	$4\frac{1}{8}$	22	$11\frac{3}{4}$	7	$7\frac{1}{8}$	23	$9\frac{1}{8}$	7	$10\frac{1}{8}$	24	$6\frac{5}{8}$
7	$1\frac{1}{4}$	22	$2\frac{11}{16}$	7	$4\frac{1}{4}$	23	$0\frac{1}{8}$	7	$7\frac{1}{4}$	23	$9\frac{1}{2}$	7	$10\frac{1}{4}$	24	7
7	$1\frac{3}{8}$	22	$3\frac{1}{16}$	7	$4\frac{3}{8}$	23	$0\frac{1}{2}$	7	$7\frac{3}{8}$	23	$9\frac{15}{16}$	7	$10\frac{3}{8}$	24	$7\frac{3}{8}$
7	$1\frac{1}{2}$	22	$3\frac{7}{16}$	7	$4\frac{1}{2}$	23	$0\frac{15}{16}$	7	$7\frac{1}{2}$	23	$10\frac{5}{16}$	7	$10\frac{1}{2}$	24	$7\frac{3}{4}$
7	$1\frac{5}{8}$	22	$3\frac{7}{8}$	7	$4\frac{5}{8}$	23	$1\frac{5}{16}$	7	$7\frac{5}{8}$	23	$10\frac{3}{4}$	7	$10\frac{5}{8}$	24	$8\frac{1}{8}$
7	$1\frac{3}{4}$	22	$4\frac{1}{4}$	7	$4\frac{3}{4}$	23	$1\frac{11}{16}$	7	$7\frac{3}{4}$	23	$11\frac{1}{8}$	7	$10\frac{3}{4}$	24	$8\frac{1}{2}$
7	$1\frac{7}{8}$	22	$4\frac{5}{8}$	7	$4\frac{7}{8}$	23	$2\frac{1}{16}$	7	$7\frac{7}{8}$	23	$11\frac{1}{4}$	7	$10\frac{7}{8}$	24	$8\frac{7}{8}$
7	2	22	5	7	5	23	$2\frac{7}{16}$	7	8	23	$11\frac{7}{8}$	7	11	24	$9\frac{5}{16}$
7	$2\frac{1}{8}$	22	$5\frac{7}{16}$	7	$5\frac{1}{8}$	23	$2\frac{13}{16}$	7	$8\frac{1}{8}$	24	$0\frac{1}{4}$	7	$11\frac{1}{8}$	24	$9\frac{3}{4}$
7	$2\frac{1}{4}$	22	$5\frac{13}{16}$	7	$5\frac{1}{4}$	23	$3\frac{1}{8}$	7	$8\frac{1}{4}$	24	$0\frac{5}{8}$	7	$11\frac{1}{4}$	24	$10\frac{1}{8}$
7	$2\frac{3}{8}$	22	$6\frac{1}{4}$	7	$5\frac{3}{8}$	23	$3\frac{9}{16}$	7	$8\frac{3}{8}$	24	1	7	$11\frac{3}{8}$	24	$10\frac{1}{2}$
7	$2\frac{1}{2}$	22	$6\frac{5}{8}$	7	$5\frac{1}{2}$	23	4	7	$8\frac{1}{2}$	24	$1\frac{7}{16}$	7	$11\frac{1}{2}$	24	$10\frac{7}{8}$
7	$2\frac{5}{8}$	22	$7\frac{1}{16}$	7	$5\frac{5}{8}$	23	$4\frac{7}{16}$	7	$8\frac{5}{8}$	24	$1\frac{7}{8}$	7	$11\frac{5}{8}$	24	$11\frac{1}{4}$
7	$2\frac{3}{4}$	22	$7\frac{7}{16}$	7	$5\frac{3}{4}$	23	$4\frac{7}{8}$	7	$8\frac{3}{4}$	24	$2\frac{1}{4}$	7	$11\frac{3}{4}$	24	$11\frac{5}{8}$
7	$2\frac{7}{8}$	22	$7\frac{13}{16}$	7	$5\frac{7}{8}$	23	$5\frac{1}{4}$	7	$8\frac{7}{8}$	24	$2\frac{5}{8}$	7	$11\frac{7}{8}$	25	0
7	3	22	$8\frac{3}{16}$	7	6	23	$5\frac{5}{8}$	7	9	24	3	8	0	25	$0\frac{7}{16}$
7	$3\frac{1}{8}$	22	$8\frac{1}{2}$	7	$6\frac{1}{8}$	23	6	7	$9\frac{1}{8}$	24	$3\frac{7}{16}$	8	$0\frac{1}{8}$	25	$0\frac{7}{8}$
7	$3\frac{1}{4}$	22	$8\frac{7}{8}$	7	$6\frac{1}{4}$	23	$6\frac{3}{8}$	7	$9\frac{1}{4}$	24	$3\frac{13}{16}$	8	$0\frac{1}{4}$	25	$1\frac{1}{4}$
7	$3\frac{3}{8}$	22	$9\frac{5}{16}$	7	$6\frac{3}{8}$	23	$6\frac{3}{4}$	7	$9\frac{3}{8}$	24	$4\frac{3}{16}$	8	$0\frac{3}{8}$	25	$1\frac{5}{8}$
7	$3\frac{1}{2}$	22	$9\frac{3}{4}$	7	$6\frac{1}{2}$	23	$7\frac{3}{16}$	7	$9\frac{1}{2}$	24	$4\frac{9}{16}$	8	$0\frac{1}{2}$	25	$2\frac{1}{16}$
7	$3\frac{5}{8}$	22	$10\frac{1}{8}$	7	$6\frac{5}{8}$	23	$7\frac{5}{8}$	7	$9\frac{5}{8}$	24	$4\frac{15}{16}$	8	$0\frac{5}{8}$	25	$2\frac{7}{16}$
7	$3\frac{3}{4}$	22	$10\frac{1}{2}$	7	$6\frac{3}{4}$	23	8	7	$9\frac{3}{4}$	24	$5\frac{5}{16}$	8	$0\frac{3}{4}$	25	$2\frac{13}{16}$
7	$3\frac{7}{8}$	22	$10\frac{7}{8}$	7	$6\frac{7}{8}$	23	$8\frac{3}{8}$	7	$9\frac{7}{8}$	24	$5\frac{3}{4}$	8	$0\frac{7}{8}$	25	$3\frac{3}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{7}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
0	10	2	$6\frac{1}{8}$	1	1	3	$3\frac{7}{16}$	1	4	4	$0\frac{7}{8}$	1	7	4	$10\frac{3}{8}$	1	10	5	$7\frac{3}{4}$
0	$10\frac{1}{8}$	2	$6\frac{1}{2}$	1	$1\frac{1}{8}$	3	$3\frac{7}{8}$	1	$4\frac{1}{8}$	4	$1\frac{5}{16}$	1	$7\frac{1}{8}$	4	$10\frac{3}{4}$	1	$10\frac{1}{8}$	5	$8\frac{3}{16}$
0	$10\frac{1}{4}$	2	$6\frac{7}{8}$	1	$1\frac{1}{4}$	3	$4\frac{5}{16}$	1	$4\frac{1}{4}$	4	$1\frac{3}{4}$	1	$7\frac{1}{4}$	4	$11\frac{1}{8}$	1	$10\frac{1}{4}$	5	$8\frac{5}{8}$
0	$10\frac{3}{8}$	2	$7\frac{5}{16}$	1	$1\frac{3}{8}$	3	$4\frac{11}{16}$	1	$4\frac{3}{8}$	4	$2\frac{1}{8}$	1	$7\frac{3}{8}$	4	$11\frac{1}{2}$	1	$10\frac{3}{8}$	5	$9\frac{1}{16}$
0	$10\frac{1}{2}$	2	$7\frac{13}{16}$	1	$1\frac{1}{2}$	3	$5\frac{1}{16}$	1	$4\frac{1}{2}$	4	$2\frac{1}{2}$	1	$7\frac{1}{2}$	4	$11\frac{15}{16}$	1	$10\frac{1}{2}$	5	$9\frac{1}{2}$
0	$10\frac{5}{8}$	2	$8\frac{1}{8}$	1	$1\frac{5}{8}$	3	$5\frac{7}{16}$	1	$4\frac{5}{8}$	4	$2\frac{7}{8}$	1	$7\frac{5}{8}$	5	$0\frac{5}{16}$	1	$10\frac{5}{8}$	5	$9\frac{7}{8}$
0	$10\frac{3}{4}$	2	$8\frac{1}{2}$	1	$1\frac{3}{4}$	3	$5\frac{7}{8}$	1	$4\frac{3}{4}$	4	$3\frac{1}{4}$	1	$7\frac{3}{4}$	5	$0\frac{11}{16}$	1	$10\frac{3}{4}$	5	$10\frac{1}{4}$
0	$10\frac{7}{8}$	2	$8\frac{7}{8}$	1	$1\frac{7}{8}$	3	$6\frac{1}{4}$	1	$4\frac{7}{8}$	4	$3\frac{5}{8}$	1	$7\frac{7}{8}$	5	$1\frac{1}{8}$	1	$10\frac{7}{8}$	5	$10\frac{11}{16}$
0	11	2	$9\frac{1}{4}$	1	2	3	$6\frac{5}{8}$	1	5	4	$4\frac{1}{16}$	1	8	5	$1\frac{1}{2}$	1	11	5	$11\frac{1}{8}$
0	$11\frac{1}{8}$	2	$9\frac{5}{8}$	1	$2\frac{1}{8}$	3	7	1	$5\frac{1}{8}$	4	$4\frac{1}{2}$	1	$8\frac{1}{8}$	5	$1\frac{7}{8}$	1	$11\frac{1}{8}$	5	$11\frac{1}{2}$
0	$11\frac{1}{4}$	2	10	1	$2\frac{1}{4}$	3	$7\frac{7}{16}$	1	$5\frac{1}{4}$	4	$4\frac{7}{8}$	1	$8\frac{1}{4}$	5	$2\frac{5}{16}$	1	$11\frac{1}{4}$	5	$11\frac{15}{16}$
0	$11\frac{3}{8}$	2	$10\frac{7}{16}$	1	$2\frac{3}{8}$	3	$7\frac{13}{16}$	1	$5\frac{3}{8}$	4	$5\frac{1}{4}$	1	$8\frac{3}{8}$	5	$2\frac{5}{8}$	1	$11\frac{3}{8}$	6	$0\frac{5}{16}$
0	$11\frac{1}{2}$	2	$10\frac{13}{16}$	1	$2\frac{1}{2}$	3	$8\frac{3}{16}$	1	$5\frac{1}{2}$	4	$5\frac{5}{8}$	1	$8\frac{1}{2}$	5	$3\frac{1}{16}$	1	$11\frac{1}{2}$	6	$0\frac{11}{16}$
0	$11\frac{5}{8}$	2	$11\frac{3}{16}$	1	$2\frac{5}{8}$	3	$8\frac{11}{16}$	1	$5\frac{5}{8}$	4	6	1	$8\frac{5}{8}$	5	$3\frac{1}{2}$	1	$11\frac{5}{8}$	6	$1\frac{1}{16}$
0	$11\frac{3}{4}$	2	$11\frac{5}{8}$	1	$2\frac{3}{4}$	3	$9\frac{1}{16}$	1	$5\frac{3}{4}$	4	$6\frac{7}{16}$	1	$8\frac{3}{4}$	5	$3\frac{7}{8}$	1	$11\frac{3}{4}$	6	$1\frac{7}{16}$
0	$11\frac{7}{8}$	2	$11\frac{15}{16}$	1	$2\frac{7}{8}$	3	$9\frac{7}{16}$	1	$5\frac{7}{8}$	4	$6\frac{13}{16}$	1	$8\frac{7}{8}$	5	$4\frac{1}{4}$	1	$11\frac{7}{8}$	6	$1\frac{13}{16}$
1	0	3	$0\frac{3}{8}$	1	3	3	$9\frac{13}{16}$	1	6	4	$7\frac{3}{16}$	1	9	5	$4\frac{5}{8}$	2	0	6	$2\frac{1}{4}$
1	$0\frac{1}{8}$	3	$0\frac{3}{4}$	1	$3\frac{1}{8}$	3	$10\frac{3}{16}$	1	$6\frac{1}{8}$	4	$7\frac{9}{16}$	1	$9\frac{1}{8}$	5	5	2	$0\frac{1}{8}$	6	$2\frac{5}{8}$
1	$0\frac{1}{4}$	3	$1\frac{1}{8}$	1	$3\frac{1}{4}$	3	$10\frac{5}{8}$	1	$6\frac{1}{4}$	4	$7\frac{15}{16}$	1	$9\frac{1}{4}$	5	$5\frac{7}{16}$	2	$0\frac{1}{4}$	6	$3\frac{1}{16}$
1	$0\frac{3}{8}$	3	$1\frac{1}{2}$	1	$3\frac{3}{8}$	3	11	1	$6\frac{3}{8}$	4	$8\frac{5}{16}$	1	$9\frac{3}{8}$	5	$5\frac{13}{16}$	2	$0\frac{3}{8}$	6	$3\frac{7}{16}$
1	$0\frac{1}{2}$	3	$1\frac{15}{16}$	1	$3\frac{1}{2}$	3	$11\frac{7}{16}$	1	$6\frac{1}{2}$	4	$8\frac{3}{4}$	1	$9\frac{1}{2}$	5	$6\frac{3}{16}$	2	$0\frac{1}{2}$	6	$3\frac{13}{16}$
1	$0\frac{5}{8}$	3	$2\frac{5}{16}$	1	$3\frac{5}{8}$	3	$11\frac{11}{16}$	1	$6\frac{5}{8}$	4	$9\frac{3}{16}$	1	$9\frac{5}{8}$	5	$6\frac{9}{16}$	2	$0\frac{5}{8}$	6	$4\frac{3}{16}$
1	$0\frac{3}{4}$	3	$2\frac{11}{16}$	1	$3\frac{3}{4}$	4	0	1	$6\frac{3}{4}$	4	$9\frac{9}{16}$	1	$9\frac{3}{4}$	5	7	2	$0\frac{3}{4}$	6	$4\frac{9}{16}$
1	$0\frac{7}{8}$	3	$3\frac{1}{16}$	1	$3\frac{7}{8}$	4	$0\frac{7}{16}$	1	$6\frac{7}{8}$	4	$9\frac{15}{16}$	1	$9\frac{7}{8}$	5	$7\frac{3}{8}$	2	$0\frac{7}{8}$	6	$4\frac{15}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{7}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 $5\frac{5}{16}$	2 4	7 $2\frac{9}{16}$	2 7	8 $0\frac{1}{16}$	2 10	8 $9\frac{1}{2}$	3 1	9 7
2 $1\frac{1}{8}$	6 $5\frac{11}{16}$	2 $4\frac{1}{8}$	7 $2\frac{15}{16}$	2 $7\frac{1}{8}$	8 $0\frac{7}{16}$	2 $10\frac{1}{8}$	8 $9\frac{15}{16}$	3 $1\frac{1}{8}$	9 $7\frac{3}{8}$
2 $1\frac{1}{4}$	6 $6\frac{1}{16}$	2 $4\frac{1}{4}$	7 $3\frac{5}{16}$	2 $7\frac{1}{4}$	8 $0\frac{13}{16}$	2 $10\frac{1}{4}$	8 $10\frac{1}{4}$	3 $1\frac{1}{4}$	9 $7\frac{3}{4}$
2 $1\frac{3}{8}$	6 $6\frac{7}{16}$	2 $4\frac{3}{8}$	7 $3\frac{3}{4}$	2 $7\frac{3}{8}$	8 $1\frac{3}{16}$	2 $10\frac{3}{8}$	8 $10\frac{6}{8}$	3 $1\frac{3}{8}$	9 $8\frac{1}{8}$
2 $1\frac{1}{2}$	6 $6\frac{3}{4}$	2 $4\frac{1}{2}$	7 $4\frac{3}{16}$	2 $7\frac{1}{2}$	8 $1\frac{9}{16}$	2 $10\frac{1}{2}$	8 $11\frac{1}{16}$	3 $1\frac{1}{2}$	9 $8\frac{1}{2}$
2 $1\frac{5}{8}$	6 $7\frac{1}{8}$	2 $4\frac{5}{8}$	7 $4\frac{9}{16}$	2 $7\frac{5}{8}$	8 $1\frac{15}{16}$	2 $10\frac{5}{8}$	8 $11\frac{7}{16}$	3 $1\frac{5}{8}$	9 $8\frac{7}{8}$
2 $1\frac{3}{4}$	6 $7\frac{1}{2}$	2 $4\frac{3}{4}$	7 $4\frac{15}{16}$	2 $7\frac{3}{4}$	8 $2\frac{3}{8}$	2 $10\frac{3}{4}$	8 $11\frac{13}{16}$	3 $1\frac{3}{4}$	9 $9\frac{1}{4}$
2 $1\frac{7}{8}$	6 $7\frac{7}{8}$	2 $4\frac{7}{8}$	7 $5\frac{5}{16}$	2 $7\frac{7}{8}$	8 $2\frac{3}{4}$	2 $10\frac{7}{8}$	9 $0\frac{3}{16}$	3 $1\frac{7}{8}$	9 $9\frac{5}{8}$
2 2	6 $8\frac{5}{16}$	2 5	7 $5\frac{11}{16}$	2 8	8 $3\frac{3}{16}$	2 11	9 $0\frac{5}{8}$	3 2	9 $10\frac{1}{16}$
2 $2\frac{1}{8}$	6 $8\frac{3}{4}$	2 $5\frac{1}{8}$	7 $6\frac{1}{16}$	2 $8\frac{1}{8}$	8 $3\frac{9}{16}$	2 $11\frac{1}{8}$	9 1	3 $2\frac{1}{8}$	9 $10\frac{1}{2}$
2 $2\frac{1}{4}$	6 $9\frac{1}{8}$	2 $5\frac{1}{4}$	7 $6\frac{7}{16}$	2 $8\frac{1}{4}$	8 4	2 $11\frac{1}{4}$	9 $1\frac{3}{8}$	3 $2\frac{1}{4}$	9 $10\frac{7}{8}$
2 $2\frac{3}{8}$	6 $9\frac{1}{2}$	2 $5\frac{3}{8}$	7 $6\frac{13}{16}$	2 $8\frac{3}{8}$	8 $4\frac{3}{8}$	2 $11\frac{3}{8}$	9 $1\frac{13}{16}$	3 $2\frac{3}{8}$	9 $11\frac{1}{4}$
2 $2\frac{1}{2}$	6 $9\frac{15}{16}$	2 $5\frac{1}{2}$	7 $7\frac{5}{16}$	2 $8\frac{1}{2}$	8 $4\frac{3}{4}$	2 $11\frac{1}{2}$	9 $2\frac{3}{16}$	3 $2\frac{1}{2}$	9 $11\frac{5}{8}$
2 $2\frac{5}{8}$	6 $10\frac{5}{16}$	2 $5\frac{5}{8}$	7 $7\frac{11}{16}$	2 $8\frac{5}{8}$	8 $5\frac{1}{8}$	2 $11\frac{5}{8}$	9 $2\frac{9}{16}$	3 $2\frac{5}{8}$	10 0
2 $2\frac{3}{4}$	6 $10\frac{3}{4}$	2 $5\frac{3}{4}$	7 $8\frac{1}{16}$	2 $8\frac{3}{4}$	8 $5\frac{1}{2}$	2 $11\frac{3}{4}$	9 3	3 $2\frac{3}{4}$	10 $0\frac{3}{8}$
2 $2\frac{7}{8}$	6 $11\frac{1}{8}$	2 $5\frac{7}{8}$	7 $8\frac{7}{16}$	2 $8\frac{7}{8}$	8 $5\frac{7}{8}$	2 $11\frac{7}{8}$	9 $3\frac{3}{8}$	3 $2\frac{7}{8}$	10 $0\frac{3}{4}$
2 3	6 $11\frac{9}{16}$	2 6	7 $8\frac{7}{8}$	2 9	8 $6\frac{1}{4}$	3 0	9 $3\frac{3}{4}$	3 3	10 $1\frac{3}{16}$
2 $3\frac{1}{8}$	6 $11\frac{15}{16}$	2 $6\frac{1}{8}$	7 $9\frac{5}{16}$	2 $9\frac{1}{8}$	8 $6\frac{11}{16}$	3 $0\frac{1}{8}$	9 $4\frac{1}{8}$	3 $3\frac{1}{8}$	10 $1\frac{9}{16}$
2 $3\frac{1}{4}$	7 $0\frac{5}{16}$	2 $6\frac{1}{4}$	7 $9\frac{11}{16}$	2 $9\frac{1}{4}$	8 $7\frac{1}{8}$	3 $0\frac{1}{4}$	9 $4\frac{1}{2}$	3 $3\frac{1}{4}$	10 2
2 $3\frac{3}{8}$	7 $0\frac{11}{16}$	2 $6\frac{3}{8}$	7 $10\frac{1}{16}$	2 $9\frac{3}{8}$	8 $7\frac{1}{2}$	3 $0\frac{3}{8}$	9 $4\frac{7}{8}$	3 $3\frac{3}{8}$	10 $2\frac{3}{8}$
2 $3\frac{1}{2}$	7 $1\frac{1}{16}$	2 $6\frac{1}{2}$	7 $10\frac{1}{2}$	2 $9\frac{1}{2}$	8 $7\frac{7}{8}$	3 $0\frac{1}{2}$	9 $5\frac{5}{16}$	3 $3\frac{1}{2}$	10 $2\frac{3}{4}$
2 $3\frac{5}{8}$	7 $1\frac{7}{16}$	2 $6\frac{5}{8}$	7 $10\frac{7}{8}$	2 $9\frac{5}{8}$	8 $8\frac{1}{4}$	3 $0\frac{5}{8}$	9 $5\frac{3}{4}$	3 $3\frac{5}{8}$	10 $3\frac{1}{8}$
2 $3\frac{3}{4}$	7 $1\frac{13}{16}$	2 $6\frac{3}{4}$	7 $11\frac{1}{4}$	2 $9\frac{3}{4}$	8 $8\frac{11}{16}$	3 $0\frac{3}{4}$	9 $6\frac{1}{8}$	3 $3\frac{3}{4}$	10 $3\frac{9}{16}$
2 $3\frac{7}{8}$	7 $2\frac{3}{16}$	2 $6\frac{7}{8}$	7 $11\frac{5}{8}$	2 $9\frac{7}{8}$	8 $9\frac{1}{16}$	3 $0\frac{7}{8}$	9 $6\frac{9}{16}$	3 $3\frac{7}{8}$	10 4

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{7}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 4	10 4⅜	3 7	11 1¾	3 10	11 11⅛	4 1	12 8⅝	4 4	13 6
3 4⅛	10 4¾	3 7⅛	11 2 3/16	3 10⅛	11 11 9/16	4 1⅛	12 9 1/16	4 4⅛	13 6⅜
3 4¼	10 5⅛	3 7¼	11 2 9/16	3 10¼	12 0	4 1¼	12 9 7/16	4 4¼	13 6¾
3 4⅜	10 5 9/16	3 7⅜	11	3 10⅜	12 0⅜	4 1⅜	12 9 13/16	4 4⅜	13 7 3/16
3 4½	10 6	3 7½	11 3⅜	3 10½	12 0¼	4 1½	12 10¼	4 4½	13 7 9/16
3 4⅝	10 6⅜	3 7⅝	11 3¾	3 10⅝	12 1⅛	4 1⅝	12 10⅝	4 4⅝	13 8
3 4¾	10 6¾	3 7¾	11 4⅛	3 10¾	12 1½	4 1¾	12 11	4 4¾	13 8⅜
3 4⅞	10 7 3/16	3 7⅞	11 4½	3 10⅞	12 1⅞	4 1⅞	12 11⅜	4 4⅞	13 8¾
3 5	10 7½	3 8	11 4⅞	3 11	12 2 5/16	4 2	12 11¾	4 5	13 9 3/16
3 5⅛	10 7⅞	3 8⅛	11 5 5/16	3 11⅛	12 2 11/16	4 2⅛	13 0 3/16	4 5⅛	13 9 9/16
3 5¼	10 8¼	3 8¼	11 5 11/16	3 11¼	12 3 1/16	4 2¼	13 0 9/16	4 5¼	13 10
3 5⅜	10 8⅝	3 8⅜	11 6 1/16	3 11⅜	12 3 7/16	4 2⅜	13 0 15/16	4 5⅜	13 10⅜
3 5½	10 9	3 8½	11 6 7/16	3 11½	12 3 13/16	4 2½	13 1 5/16	4 5½	13 10¾
3 5⅝	10 9⅜	3 8⅝	11 6 13/16	3 11⅝	12 4 3/16	4 2⅝	13 1 11/16	4 5⅝	13 11⅛
3 5¾	10 9¾	3 8¾	11 7 3/16	3 11¾	12 4⅝	4 2¾	13 2 1/16	4 5¾	13 11½
3 5⅞	10 10 3/16	3 8⅞	11 7⅝	3 11⅞	12 5 1/16	4 2⅞	13 2 7/16	4 5⅞	13 11⅞
3 6	10 10⅝	3 9	11 8 1/16	4 0	12 5½	4 3	13 2⅞	4 6	14 0 5/16
3 6⅛	10 11 1/16	3 9⅛	11 8 7/16	4 0⅛	12 5⅞	4 3⅛	13 3 5/16	4 6⅛	14 0¾
3 6¼	10 11 7/16	3 9¼	11 8 13/16	4 0¼	12 6¼	4 3¼	13 3 11/16	4 6¼	14 1 3/16
3 6⅜	10 11 13/16	3 9⅜	11 9⅛	4 0⅜	12 6⅝	4 3⅜	13 4 1/16	4 6⅜	14 1 9/16
3 6½	11 0 3/16	3 9½	11 9½	4 0½	12 7	4 3½	13 4 7/16	4 6½	14 2
3 6⅝	11 0 9/16	3 9⅝	11 9⅞	4 0⅝	12 7⅜	4 3⅝	13 4 13/16	4 6⅝	14 2⅜
3 6¾	11 1	3 9¾	11 10¼	4 0¾	12 7¼	4 3¾	13 5 3/16	4 6¾	14 2¾
3 6⅞	11 1⅜	3 9⅞	11 10 11/16	4 0⅞	12 8 3/16	4 3⅞	13 5 9/16	4 6⅞	14 3⅛

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{7}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
4	7	14	$3\frac{1}{2}$	4	10	15	$0\frac{7}{8}$	5	1	15	$10\frac{3}{8}$	5	4	16	$7\frac{3}{4}$	5	7	17	$5\frac{1}{8}$
4	$7\frac{1}{8}$	14	$3\frac{7}{8}$	4	$10\frac{1}{8}$	15	$1\frac{1}{4}$	5	$1\frac{1}{8}$	15	$10\frac{3}{4}$	5	$4\frac{1}{8}$	16	$8\frac{3}{16}$	5	$7\frac{1}{8}$	17	$5\frac{1}{2}$
4	$7\frac{1}{4}$	14	$4\frac{5}{16}$	4	$10\frac{1}{4}$	15	$1\frac{11}{16}$	5	$1\frac{1}{4}$	15	$11\frac{1}{8}$	5	$4\frac{1}{4}$	16	$8\frac{9}{16}$	5	$7\frac{1}{4}$	17	$5\frac{7}{8}$
4	$7\frac{3}{8}$	14	$4\frac{11}{16}$	4	$10\frac{3}{8}$	15	$2\frac{1}{16}$	5	$1\frac{3}{8}$	15	$11\frac{1}{2}$	5	$4\frac{3}{8}$	16	9	5	$7\frac{3}{8}$	17	$6\frac{5}{16}$
4	$7\frac{1}{2}$	14	$5\frac{1}{16}$	4	$10\frac{1}{2}$	15	$2\frac{7}{16}$	5	$1\frac{1}{2}$	15	$11\frac{7}{8}$	5	$4\frac{1}{2}$	16	$9\frac{3}{8}$	5	$7\frac{1}{2}$	17	$6\frac{3}{4}$
4	$7\frac{5}{8}$	14	$5\frac{7}{16}$	4	$10\frac{5}{8}$	15	$2\frac{7}{8}$	5	$1\frac{5}{8}$	16	$0\frac{1}{4}$	5	$4\frac{5}{8}$	16	$9\frac{3}{4}$	5	$7\frac{5}{8}$	17	$7\frac{3}{16}$
4	$7\frac{3}{4}$	14	$5\frac{13}{16}$	4	$10\frac{3}{4}$	15	$3\frac{1}{4}$	5	$1\frac{3}{4}$	16	$0\frac{11}{16}$	5	$4\frac{3}{4}$	16	$10\frac{1}{8}$	5	$7\frac{3}{4}$	17	$7\frac{9}{16}$
4	$7\frac{7}{8}$	14	$6\frac{1}{4}$	4	$10\frac{7}{8}$	15	$3\frac{5}{8}$	5	$1\frac{7}{8}$	16	$1\frac{1}{16}$	5	$4\frac{7}{8}$	16	$10\frac{1}{2}$	5	$7\frac{7}{8}$	17	8
4	8	14	$6\frac{5}{8}$	4	11	15	4	5	2	16	$1\frac{1}{2}$	5	5	16	$10\frac{7}{8}$	5	8	17	$8\frac{3}{8}$
4	$8\frac{1}{8}$	14	$7\frac{1}{16}$	4	$11\frac{1}{8}$	15	$4\frac{3}{8}$	5	$2\frac{1}{8}$	16	$1\frac{7}{8}$	5	$5\frac{1}{8}$	16	$11\frac{5}{16}$	5	$8\frac{1}{8}$	17	$8\frac{3}{4}$
4	$8\frac{1}{4}$	14	$7\frac{7}{16}$	4	$11\frac{1}{4}$	15	$4\frac{3}{4}$	5	$2\frac{1}{4}$	16	$2\frac{5}{16}$	5	$5\frac{1}{4}$	16	$11\frac{11}{16}$	5	$8\frac{1}{4}$	17	$9\frac{1}{8}$
4	$8\frac{3}{8}$	14	$7\frac{13}{16}$	4	$11\frac{3}{8}$	15	$5\frac{3}{16}$	5	$2\frac{3}{8}$	16	$2\frac{11}{16}$	5	$5\frac{3}{8}$	17	$0\frac{1}{16}$	5	$8\frac{3}{8}$	17	$9\frac{1}{2}$
4	$8\frac{1}{2}$	14	$8\frac{3}{16}$	4	$11\frac{1}{2}$	15	$5\frac{5}{8}$	5	$2\frac{1}{2}$	16	$3\frac{1}{16}$	5	$5\frac{1}{2}$	17	$0\frac{1}{2}$	5	$8\frac{1}{2}$	17	$9\frac{7}{8}$
4	$8\frac{5}{8}$	14	$8\frac{9}{16}$	4	$11\frac{5}{8}$	15	6	5	$2\frac{5}{8}$	16	$3\frac{7}{16}$	5	$5\frac{5}{8}$	17	$0\frac{7}{8}$	5	$8\frac{5}{8}$	17	$10\frac{5}{16}$
4	$8\frac{3}{4}$	14	9	4	$11\frac{3}{4}$	15	$6\frac{3}{8}$	5	$2\frac{3}{4}$	16	$3\frac{13}{16}$	5	$5\frac{3}{4}$	17	$1\frac{1}{4}$	5	$8\frac{3}{4}$	17	$10\frac{11}{16}$
4	$8\frac{7}{8}$	14	$9\frac{3}{8}$	4	$11\frac{7}{8}$	15	$6\frac{3}{4}$	5	$2\frac{7}{8}$	16	$4\frac{3}{16}$	5	$5\frac{7}{8}$	17	$1\frac{5}{8}$	5	$8\frac{7}{8}$	17	$11\frac{1}{16}$
4	9	14	$9\frac{3}{4}$	5	0	15	$7\frac{1}{8}$	5	3	16	$4\frac{5}{8}$	5	6	17	2	5	9	17	$11\frac{7}{16}$
4	$9\frac{1}{8}$	14	$10\frac{3}{16}$	5	$0\frac{1}{8}$	15	$7\frac{1}{2}$	5	$3\frac{1}{8}$	16	$5\frac{1}{16}$	5	$6\frac{1}{8}$	17	$2\frac{7}{16}$	5	$9\frac{1}{8}$	17	$11\frac{7}{8}$
4	$9\frac{1}{4}$	14	$10\frac{9}{16}$	5	$0\frac{1}{4}$	15	$7\frac{7}{8}$	5	$3\frac{1}{4}$	16	$5\frac{7}{16}$	5	$6\frac{1}{4}$	17	$2\frac{13}{16}$	5	$9\frac{1}{4}$	18	$0\frac{1}{4}$
4	$9\frac{3}{8}$	14	11	5	$0\frac{3}{8}$	15	$8\frac{5}{16}$	5	$3\frac{3}{8}$	16	$5\frac{13}{16}$	5	$6\frac{3}{8}$	17	$3\frac{3}{16}$	5	$9\frac{3}{8}$	18	$0\frac{5}{8}$
4	$9\frac{1}{2}$	14	$11\frac{3}{8}$	5	$0\frac{1}{2}$	15	$8\frac{3}{4}$	5	$3\frac{1}{2}$	16	$6\frac{3}{16}$	5	$6\frac{1}{2}$	17	$3\frac{5}{8}$	5	$9\frac{1}{2}$	18	1
4	$9\frac{5}{8}$	14	$11\frac{3}{4}$	5	$0\frac{5}{8}$	15	$9\frac{3}{16}$	5	$3\frac{5}{8}$	16	$6\frac{9}{16}$	5	$6\frac{5}{8}$	17	4	5	$9\frac{5}{8}$	18	$1\frac{3}{8}$
4	$9\frac{3}{4}$	15	$0\frac{1}{8}$	5	$0\frac{3}{4}$	15	$9\frac{9}{16}$	5	$3\frac{3}{4}$	16	7	5	$6\frac{3}{4}$	17	$4\frac{3}{8}$	5	$9\frac{3}{4}$	18	$1\frac{13}{16}$
4	$9\frac{7}{8}$	15	$0\frac{1}{2}$	5	$0\frac{7}{8}$	15	10	5	$3\frac{7}{8}$	16	$7\frac{3}{8}$	5	$6\frac{7}{8}$	17	$4\frac{3}{4}$	5	$9\frac{7}{8}$	18	$2\frac{3}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{7}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
5 10	18 $2\frac{5}{8}$	6 1	19 0	6 4	19 $9\frac{7}{16}$	6 7	20 $6\frac{7}{8}$	6 10	21 $4\frac{1}{4}$
5 $10\frac{1}{8}$	18 $3\frac{1}{16}$	6 $1\frac{1}{8}$	19 $0\frac{3}{8}$	6 $4\frac{1}{8}$	19 $9\frac{13}{16}$	6 $7\frac{1}{8}$	20 $7\frac{5}{16}$	6 $10\frac{1}{8}$	21 $4\frac{11}{16}$
5 $10\frac{1}{4}$	18 $3\frac{7}{16}$	6 $1\frac{1}{4}$	19 $0\frac{13}{16}$	6 $4\frac{1}{4}$	19 $10\frac{3}{16}$	6 $7\frac{1}{4}$	20 $7\frac{11}{16}$	6 $10\frac{1}{4}$	21 $5\frac{1}{16}$
5 $10\frac{3}{8}$	18 $3\frac{13}{16}$	6 $1\frac{3}{8}$	19 $1\frac{3}{16}$	6 $4\frac{3}{8}$	19 $10\frac{9}{16}$	6 $7\frac{3}{8}$	20 $8\frac{1}{16}$	6 $10\frac{3}{8}$	21 $5\frac{7}{16}$
5 $10\frac{1}{2}$	18 $4\frac{3}{16}$	6 $1\frac{1}{2}$	19 $1\frac{5}{8}$	6 $4\frac{1}{2}$	19 11	6 $7\frac{1}{2}$	20 $8\frac{7}{16}$	6 $10\frac{1}{2}$	21 $5\frac{7}{8}$
5 $10\frac{5}{8}$	18 $4\frac{9}{16}$	6 $1\frac{5}{8}$	19 2	6 $4\frac{5}{8}$	19 $11\frac{7}{16}$	6 $7\frac{5}{8}$	20 $8\frac{13}{16}$	6 $10\frac{5}{8}$	21 $6\frac{1}{4}$
5 $10\frac{3}{4}$	18 5	6 $1\frac{3}{4}$	19 $2\frac{3}{8}$	6 $4\frac{3}{4}$	19 $11\frac{13}{16}$	6 $7\frac{3}{4}$	20 $9\frac{3}{16}$	6 $10\frac{3}{4}$	21 $6\frac{11}{16}$
5 $10\frac{7}{8}$	18 $5\frac{3}{8}$	6 $1\frac{7}{8}$	19 $2\frac{3}{4}$	6 $4\frac{7}{8}$	20 $0\frac{1}{4}$	6 $7\frac{7}{8}$	20 $9\frac{5}{8}$	6 $10\frac{7}{8}$	21 $7\frac{1}{16}$
5 11	18 $5\frac{13}{16}$	6 2	19 $3\frac{1}{8}$	6 5	20 $0\frac{5}{8}$	6 8	20 10	6 11	21 $7\frac{7}{16}$
5 $11\frac{1}{8}$	18 $6\frac{3}{16}$	6 $2\frac{1}{8}$	19 $3\frac{9}{16}$	6 $5\frac{1}{8}$	20 1	6 $8\frac{1}{8}$	20 $10\frac{7}{16}$	6 $11\frac{1}{8}$	21 $7\frac{13}{16}$
5 $11\frac{1}{4}$	18 $6\frac{9}{16}$	6 $2\frac{1}{4}$	19 4	6 $5\frac{1}{4}$	20 $1\frac{3}{8}$	6 $8\frac{1}{4}$	20 $10\frac{13}{16}$	6 $11\frac{1}{4}$	21 $8\frac{3}{16}$
5 $11\frac{3}{8}$	18 7	6 $2\frac{3}{8}$	19 $4\frac{3}{8}$	6 $5\frac{3}{8}$	20 $1\frac{3}{4}$	6 $8\frac{3}{8}$	20 $11\frac{3}{16}$	6 $11\frac{3}{8}$	21 $8\frac{9}{16}$
5 $11\frac{1}{2}$	18 $7\frac{3}{8}$	6 $2\frac{1}{2}$	19 $4\frac{3}{4}$	6 $5\frac{1}{2}$	20 $2\frac{1}{8}$	6 $8\frac{1}{2}$	20 $11\frac{9}{16}$	6 $11\frac{1}{2}$	21 9
5 $11\frac{5}{8}$	18 $7\frac{3}{4}$	6 $2\frac{5}{8}$	19 $5\frac{3}{16}$	6 $5\frac{5}{8}$	20 $2\frac{9}{16}$	6 $8\frac{5}{8}$	21 0	6 $11\frac{5}{8}$	21 $9\frac{7}{16}$
5 $11\frac{3}{4}$	18 $8\frac{1}{8}$	6 $2\frac{3}{4}$	19 $5\frac{9}{16}$	6 $5\frac{3}{4}$	20 3	6 $8\frac{3}{4}$	21 $0\frac{3}{8}$	6 $11\frac{3}{4}$	21 $9\frac{13}{16}$
5 $11\frac{7}{8}$	18 $8\frac{1}{2}$	6 $2\frac{7}{8}$	19 6	6 $5\frac{7}{8}$	20 $3\frac{3}{8}$	6 $8\frac{7}{8}$	21 $0\frac{3}{4}$	6 $11\frac{7}{8}$	21 $10\frac{3}{16}$
6 0	18 $8\frac{7}{8}$	6 3	19 $6\frac{3}{8}$	6 6	20 $3\frac{3}{4}$	6 9	21 $1\frac{1}{8}$	7 0	21 $10\frac{9}{16}$
6 $0\frac{1}{8}$	18 $9\frac{5}{16}$	6 $3\frac{1}{8}$	19 $6\frac{3}{4}$	6 $6\frac{1}{8}$	20 $4\frac{1}{8}$	6 $9\frac{1}{8}$	21 $1\frac{1}{2}$	7 $0\frac{1}{8}$	21 $10\frac{15}{16}$
6 $0\frac{1}{4}$	18 $9\frac{11}{16}$	6 $3\frac{1}{4}$	19 $7\frac{1}{8}$	6 $6\frac{1}{4}$	20 $4\frac{1}{2}$	6 $9\frac{1}{4}$	21 $1\frac{7}{8}$	7 $0\frac{1}{4}$	21 $11\frac{5}{16}$
6 $0\frac{3}{8}$	18 $10\frac{1}{16}$	6 $3\frac{3}{8}$	19 $7\frac{1}{2}$	6 $6\frac{3}{8}$	20 $4\frac{7}{8}$	6 $9\frac{3}{8}$	21 $2\frac{5}{16}$	7 $0\frac{3}{8}$	21 $11\frac{11}{16}$
6 $0\frac{1}{2}$	18 $10\frac{7}{16}$	6 $3\frac{1}{2}$	19 $7\frac{7}{8}$	6 $6\frac{1}{2}$	20 $5\frac{1}{4}$	6 $9\frac{1}{2}$	21 $2\frac{11}{16}$	7 $0\frac{1}{2}$	22 $0\frac{1}{8}$
6 $0\frac{5}{8}$	18 $10\frac{7}{8}$	6 $3\frac{5}{8}$	19 $8\frac{5}{16}$	6 $6\frac{5}{8}$	20 $5\frac{11}{16}$	6 $9\frac{5}{8}$	21 $3\frac{1}{8}$	7 $0\frac{5}{8}$	22 $0\frac{9}{16}$
6 $0\frac{3}{4}$	18 $11\frac{1}{4}$	6 $3\frac{3}{4}$	19 $8\frac{11}{16}$	6 $6\frac{3}{4}$	20 $6\frac{1}{16}$	6 $9\frac{3}{4}$	21 $3\frac{1}{2}$	7 $0\frac{3}{4}$	22 1
6 $0\frac{7}{8}$	18 $11\frac{5}{8}$	6 $3\frac{7}{8}$	19 $9\frac{1}{16}$	6 $6\frac{7}{8}$	20 $6\frac{7}{16}$	6 $9\frac{7}{8}$	21 $3\frac{7}{8}$	7 $0\frac{7}{8}$	22 $1\frac{1}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE $\frac{7}{16}$ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	1	22	$1\frac{3}{4}$	7	4	22	$11\frac{1}{8}$	7	7	23	$8\frac{9}{16}$	7	10	24	6
7	$1\frac{1}{8}$	22	$2\frac{1}{8}$	7	$4\frac{1}{8}$	22	$11\frac{9}{16}$	7	$7\frac{1}{8}$	23	9	7	$10\frac{1}{8}$	24	$6\frac{7}{16}$
7	$1\frac{1}{4}$	22	$2\frac{1}{4}$	7	$4\frac{1}{4}$	23	0	7	$7\frac{1}{4}$	23	$9\frac{3}{8}$	7	$10\frac{1}{4}$	24	$6\frac{13}{16}$
7	$1\frac{3}{8}$	22	$2\frac{7}{8}$	7	$4\frac{3}{8}$	23	$0\frac{3}{8}$	7	$7\frac{3}{8}$	23	$9\frac{3}{4}$	7	$10\frac{3}{8}$	24	$7\frac{3}{16}$
7	$1\frac{1}{2}$	22	$3\frac{1}{4}$	7	$4\frac{1}{2}$	23	$0\frac{3}{4}$	7	$7\frac{1}{2}$	23	$10\frac{1}{8}$	7	$10\frac{1}{2}$	24	$7\frac{9}{16}$
7	$1\frac{5}{8}$	22	$3\frac{11}{16}$	7	$4\frac{5}{8}$	23	$1\frac{1}{8}$	7	$7\frac{5}{8}$	23	$10\frac{9}{16}$	7	$10\frac{5}{8}$	24	8
7	$1\frac{3}{4}$	22	$4\frac{1}{16}$	7	$4\frac{3}{4}$	23	$1\frac{1}{2}$	7	$7\frac{3}{4}$	23	11	7	$10\frac{3}{4}$	24	$8\frac{3}{8}$
7	$1\frac{7}{8}$	22	$4\frac{7}{16}$	7	$4\frac{7}{8}$	23	$1\frac{7}{8}$	7	$7\frac{7}{8}$	23	$11\frac{3}{8}$	7	$10\frac{7}{8}$	24	$8\frac{3}{4}$
7	2	22	$4\frac{13}{16}$	7	5	23	$2\frac{1}{4}$	7	8	23	$11\frac{3}{4}$	7	11	24	$9\frac{1}{8}$
7	$2\frac{1}{8}$	22	$5\frac{1}{4}$	7	$5\frac{1}{8}$	23	$2\frac{5}{8}$	7	$8\frac{1}{8}$	24	$0\frac{1}{8}$	7	$11\frac{1}{8}$	24	$9\frac{9}{16}$
7	$2\frac{1}{4}$	22	$5\frac{5}{8}$	7	$5\frac{1}{4}$	23	3	7	$8\frac{1}{4}$	24	$0\frac{1}{2}$	7	$11\frac{1}{4}$	24	10
7	$2\frac{3}{8}$	22	$6\frac{1}{16}$	7	$5\frac{3}{8}$	23	$3\frac{3}{8}$	7	$8\frac{3}{8}$	24	$0\frac{7}{8}$	7	$11\frac{3}{8}$	24	$10\frac{3}{8}$
7	$2\frac{1}{2}$	22	$6\frac{7}{16}$	7	$5\frac{1}{2}$	23	$3\frac{13}{16}$	7	$8\frac{1}{2}$	24	$1\frac{1}{4}$	7	$11\frac{1}{2}$	24	$10\frac{3}{4}$
7	$2\frac{5}{8}$	22	$6\frac{7}{8}$	7	$5\frac{5}{8}$	23	$4\frac{1}{4}$	7	$8\frac{5}{8}$	24	$1\frac{11}{16}$	7	$11\frac{5}{8}$	24	$11\frac{1}{8}$
7	$2\frac{3}{4}$	22	$7\frac{1}{4}$	7	$5\frac{3}{4}$	23	$4\frac{11}{16}$	7	$8\frac{3}{4}$	24	$2\frac{1}{16}$	7	$11\frac{3}{4}$	24	$11\frac{1}{2}$
7	$2\frac{7}{8}$	22	$7\frac{5}{8}$	7	$5\frac{7}{8}$	23	$5\frac{1}{16}$	7	$8\frac{7}{8}$	24	$2\frac{7}{16}$	7	$11\frac{7}{8}$	24	$11\frac{7}{8}$
7	3	22	8	7	6	23	$5\frac{7}{16}$	7	9	24	$2\frac{7}{8}$	8	0	25	$0\frac{1}{4}$
7	$3\frac{1}{8}$	22	$8\frac{5}{16}$	7	$6\frac{1}{8}$	23	$5\frac{13}{16}$	7	$9\frac{1}{8}$	24	$3\frac{1}{4}$	8	$0\frac{1}{8}$	25	$0\frac{11}{16}$
7	$3\frac{1}{4}$	22	$8\frac{11}{16}$	7	$6\frac{1}{4}$	23	$6\frac{3}{16}$	7	$9\frac{1}{4}$	24	$3\frac{5}{8}$	8	$0\frac{1}{4}$	25	$1\frac{1}{8}$
7	$3\frac{3}{8}$	22	$9\frac{1}{8}$	7	$6\frac{3}{8}$	23	$6\frac{9}{16}$	7	$9\frac{3}{8}$	24	4	8	$0\frac{3}{8}$	25	$1\frac{1}{2}$
7	$3\frac{1}{2}$	22	$9\frac{9}{16}$	7	$6\frac{1}{2}$	23	7	7	$9\frac{1}{2}$	24	$4\frac{3}{8}$	8	$0\frac{1}{2}$	25	$1\frac{7}{8}$
7	$3\frac{5}{8}$	22	$9\frac{15}{16}$	7	$6\frac{5}{8}$	23	$7\frac{7}{16}$	7	$9\frac{5}{8}$	24	$4\frac{3}{4}$	8	$0\frac{5}{8}$	25	$2\frac{1}{4}$
7	$3\frac{3}{4}$	22	$10\frac{5}{16}$	7	$6\frac{3}{4}$	23	$7\frac{13}{16}$	7	$9\frac{3}{4}$	24	$5\frac{1}{8}$	8	$0\frac{3}{4}$	25	$2\frac{11}{16}$
7	$3\frac{7}{8}$	22	$10\frac{11}{16}$	7	$6\frac{7}{8}$	23	$8\frac{3}{16}$	7	$9\frac{7}{8}$	24	$5\frac{9}{16}$	8	$0\frac{7}{8}$	25	$3\frac{1}{16}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ½ IN. THICK, from 10 in. Diameter to 8 ft. Diameter.

Diam.	Circum.	Diam.	Circum.	Diam	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in	ft. in.	ft. in	ft. in.	ft. in.	ft. in.	f. in.
0 10	2 6	1 1	3 3¼	1 4	4 0¾	1 7	4 10 3/16	1 10	5 7 11/16
0 10⅛	2 6⅜	1 1⅛	3 3⅝	1 4⅛	4 1 3/16	1 7⅛	4 10 9/16	1 10⅛	5 8⅛
0 10¼	2 6¾	1 1¼	3 4 1/16	1 4¼	4 1 9/16	1 7¼	4 11	1 10¼	5 8 9/16
0 10⅜	2 7⅛	1 1⅜	3 4½	1 4⅜	4 2	1 7⅜	4 11⅜	1 10⅜	5 9
0 10½	2 7 1/16	1 1½	3 4⅞	1 4½	4 2⅜	1 7½	4 11¾	1 10½	5 9⅜
0 10⅝	2 8	1 1⅝	3 5¼	1 4⅝	4 2¾	1 7⅝	5 0⅛	1 10⅝	5 9¾
0 10¾	2 8⅜	1 1¾	3 5⅝	1 4¾	4 3⅛	1 7¾	5 0½	1 10¾	5 10⅛
0 10⅞	2 8¾	1 1⅞	3 6	1 4⅞	4 3½	1 7⅞	5 0⅞	1 10⅞	5 10½
0 11	2 9⅛	1 2	3 6 7/16	1 5	4 3⅞	1 8	5 1 5/16	1 11	5 10⅞
0 11⅛	2 9½	1 2⅛	3 6 13/16	1 5⅛	4 4¼	1 8⅛	5 1 11/16	1 11⅛	5 11 5/16
0 11¼	2 9⅞	1 2¼	3 7 3/16	1 5¼	4 4 11/16	1 8¼	5 2 1/16	1 11¼	5 11¾
0 11⅜	2 10¼	1 2⅜	3 7⅝	1 5⅜	4 5	1 8⅜	5 2 7/16	1 11⅜	6 0⅛
0 11½	2 10⅝	1 2½	3 8 1/16	1 5½	4 5 7/16	1 8½	5 2⅞	1 11½	6 0½
0 11⅝	2 11	1 2⅝	3 8½	1 5⅝	4 5 13/16	1 8⅝	5 3¼	1 11⅝	6 0 15/16
0 11¾	2 11 7/16	1 2¾	3 8⅞	1 5¾	4 6¼	1 8¾	5 3 11/16	1 11¾	6 1 5/16
0 11⅞	2 11 13/16	1 2⅞	3 9¼	1 5⅞	4 6⅝	1 8⅞	5 4	1 11⅞	6 1¾
1 0	3 0 3/16	1 3	3 9⅝	1 6	4 7	1 9	5 4 7/16	2 0	6 2⅛
1 0⅛	3 0 9/16	1 3⅛	3 10	1 6⅛	4 7⅜	1 9⅛	5 4 13/16	2 0⅛	6 2½
1 0¼	3 1	1 3¼	3 10 7/16	1 6¼	4 7¾	1 9¼	5 5¼	2 0¼	6 2⅞
1 0⅜	3 1⅜	1 3⅜	3 10 13/16	1 6⅜	4 8⅛	1 9⅜	5 5⅝	2 0⅜	6 3¼
1 0½	3 1¾	1 3½	3 11 3/16	1 6½	4 8 9/16	1 9½	5 6 1/16	2 0½	6 3⅝
1 0⅝	3 2⅛	1 3⅝	3 11 9/16	1 6⅝	4 9	1 9⅝	5 6 7/16	2 0⅝	6 4
1 0¾	3 2½	1 3¾	3 11 15/16	1 6¾	4 9⅜	1 9¾	5 6 13/16	2 0¾	6 4⅜
1 0⅞	3 2⅞	1 3⅞	4 0 5/16	1 6⅞	4 9¾	1 9⅞	5 7¼	2 0⅞	6 4¾

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ½ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 1	6 5 1/8	2 4	7 2 7/16	2 7	7 11 7/8	2 10	8 9 5/16	3 1	9 6 3/4
2 1 1/8	6 5 1/2	2 4 1/8	7 2 13/16	2 7 1/8	8 0 1/4	2 10 1/8	8 9 3/4	3 1 1/8	9 7 1/8
2 1 1/4	6 5 7/8	2 4 1/4	7 3 3/16	2 7 1/4	8 0 5/8	2 10 1/4	8 10 1/8	3 1 1/4	9 7 1/2
2 1 3/8	6 6 1/4	2 4 3/8	7 3 9/16	2 7 3/8	8 1	2 10 3/8	8 10 1/2	3 1 3/8	9 7 7/8
2 1 1/2	6 6 5/8	2 4 1/2	7 4	2 7 1/2	8 1 3/8	2 10 1/2	8 10 7/8	3 1 1/2	9 8 5/16
2 1 5/8	6 7	2 4 5/8	7 4 3/8	2 7 5/8	8 1 3/4	2 10 5/8	8 11 1/4	3 1 5/8	9 8 11/16
2 1 3/4	6 7 3/8	2 4 3/4	7 4 3/4	2 7 3/4	8 2 3/16	2 10 3/4	8 11 5/8	3 1 3/4	9 9 1/16
2 1 7/8	6 7 3/4	2 4 7/8	7 5 1/8	2 7 7/8	8 2 9/16	2 10 7/8	9 0	3 1 7/8	9 9 7/16
2 2	6 8 3/16	2 5	7 5 1/2	2 8	8 3	2 11	9 0 7/16	3 2	9 9 7/8
2 2 1/8	6 8 9/16	2 5 1/8	7 5 7/8	2 8 1/8	8 3 3/8	2 11 1/8	9 0 13/16	3 2 1/8	9 10 5/16
2 2 1/4	6 9	2 5 1/4	7 6 1/4	2 8 1/4	8 3 3/4	2 11 1/4	9 1 3/16	3 2 1/4	9 10 11/16
2 2 3/8	6 9 3/8	2 5 3/8	7 6 5/8	2 8 3/8	8 4 1/8	2 11 3/8	9 1 5/8	3 2 3/8	9 11 1/16
2 2 1/2	6 9 3/4	2 5 1/2	7 7 1/8	2 8 1/2	8 4 9/16	2 11 1/2	9 2	3 2 1/2	9 11 7/16
2 2 5/8	6 10 1/8	2 5 5/8	7 7 1/2	2 8 5/8	8 5	2 11 5/8	9 2 3/8	3 2 5/8	9 11 13/16
2 2 3/4	6 10 1/2	2 5 3/4	7 7 7/8	2 8 3/4	8 5 3/8	2 11 3/4	9 2 3/4	3 2 3/4	10 0 3/16
2 2 7/8	6 10 7/8	2 5 7/8	7 8 1/4	2 8 7/8	8 5 3/4	2 11 7/8	9 3 1/8	3 2 7/8	10 0 9/16
2 3	6 11 5/16	2 6	7 8 11/16	2 9	8 6 1/8	3 0	9 3 9/16	3 3	10 1
2 3 1/8	6 11 3/4	2 6 1/8	7 9 1/8	2 9 1/8	8 6 1/2	3 0 1/8	9 4	3 3 1/8	10 1 3/8
2 3 1/4	7 0 1/8	2 6 1/4	7 9 1/2	2 9 1/4	8 6 7/8	3 0 1/4	9 4 3/8	3 3 1/4	10 1 13/16
2 3 3/8	7 0 1/2	2 6 3/8	7 9 7/8	2 9 3/8	8 7 1/4	3 0 3/8	9 4 3/4	3 3 3/8	10 2 3/16
2 3 1/2	7 0 7/8	2 6 1/2	7 10 5/16	2 9 1/2	8 7 11/16	3 0 1/2	9 5 3/16	3 3 1/2	10 2 9/16
2 3 5/8	7 1 1/4	2 6 5/8	7 10 11/16	2 9 5/8	8 8 1/16	3 0 5/8	9 5 9/16	3 3 5/8	10 3
2 3 3/4	7 1 5/8	2 6 3/4	7 11 1/8	2 9 3/4	8 8 1/2	3 0 3/4	9 6	3 3 3/4	10 3 3/8
2 3 7/8	7 2	2 6 7/8	7 11 1/2	2 9 7/8	8 8 7/8	3 0 7/8	9 6 3/8	3 3 7/8	10 3 3/4

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ½ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 4	10 4⅛	3 7	11 1 9/16	3 10	11 10⅞	4 1	12 8 7/16	4 4	13 5 13/16
3 4⅛	10 4½	3 7⅛	11 2	3 10⅛	11 11 5/16	4 1⅛	12 8⅞	4 4⅛	13 6⅛
3 4¼	10 4⅞	3 7¼	11 2⅜	3 10¼	11 11¾	4 1¼	12 9¼	4 4¼	13 6 9/16
3 4⅜	10 5 5/16	3 7⅜	11 2¾	3 10⅜	12 0⅛	4 1⅜	12 9⅝	4 4⅜	13 7
3 4½	10 5 11/16	3 7½	11 3⅛	3 10½	12 0½	4 1½	12 10 1/16	4 4½	13 7 7/16
3 4⅝	10 6⅛	3 7⅝	11 3½	3 10⅝	12 0⅞	4 1⅝	12 10 7/16	4 4⅝	13 7 13/16
3 4¾	10 6½	3 7¾	11 3⅞	3 10¾	12 1¼	4 1¾	12 10 13/16	4 4¾	13 8 3/16
3 4⅞	10 6⅞	3 7⅞	11 4¼	3 10⅞	12 1 11/16	4 1⅞	12 11 3/16	4 4⅞	13 8 9/16
3 5	10 7 5/16	3 8	11 4 11/16	3 11	12 2⅛	4 2	12 11 9/16	4 5	13 9
3 5⅛	10 7 11/16	3 8⅛	11 5 1/16	3 11⅛	12 2½	4 2⅛	13 0	4 5⅛	13 9⅜
3 5¼	10 8 1/16	3 8¼	11 5½	3 11¼	12 2⅞	4 2¼	13 0⅜	4 5¼	13 9¾
3 5⅜	10 8 7/16	3 8⅜	11 5⅞	3 11⅜	12 3¼	4 2⅜	13 0¾	4 5⅜	13 10⅛
3 5½	10 8 13/16	3 8½	11 6¼	3 11½	12 3⅝	4 2½	13 1⅛	4 5½	13 10½
3 5⅝	10 9 3/16	3 8⅝	11 6⅝	3 11⅝	12 4	4 2⅝	13 1½	4 5⅝	13 10⅞
3 5¾	10 9 9/16	3 8¾	11 7	3 11¾	12 4 7/16	4 2¾	13 1⅞	4 5¾	13 11 5/16
3 5⅞	10 10	3 8⅞	11 7⅜	3 11⅞	12 4⅞	4 2⅞	13 2¼	4 5⅞	13 11 11/16
3 6	10 10 7/16	3 9	11 7⅞	4 0	12 5 5/16	4 3	13 2 11/16	4 6	14 0⅛
3 6⅛	10 10⅞	3 9⅛	11 8¼	4 0⅛	12 5 11/16	4 3⅛	13 3⅛	4 6⅛	14 0 9/16
3 6¼	10 11¼	3 9¼	11 8⅝	4 0¼	12 6 1/16	4 3¼	13 3½	4 6¼	14 1
3 6⅜	10 11⅝	3 9⅜	11 9	4 0⅜	12 6 7/16	4 3⅜	13 3⅞	4 6⅜	14 1⅜
3 6½	11 0	3 9½	11 9⅜	4 0½	12 6 13/16	4 3½	13 4¼	4 6½	14 1¾
3 6⅝	11 0⅜	3 9⅝	11 9¾	4 0⅝	12 7 3/16	4 3⅝	13 4⅝	4 6⅝	14 2⅛
3 6¾	11 0 13/16	3 9¾	11 10⅛	4 0¾	12 7 9/16	4 3¾	13 5	4 6¾	14 2½
3 6⅞	11 1 3/16	3 9⅞	11 10½	4 0⅞	12 8	4 3⅞	13 5⅜	4 6⅞	14 2⅞

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ½ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued*.

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
4 7	14 3 5/16	4 10	15 0 1/16	5 1	15 10 1/8	5 4	16 7 1/2	5 7	17 5
4 7 1/8	14 3 1/16	4 10 1/8	15 1 1/16	5 1 1/8	15 10 1/2	5 4 1/8	16 7 7/8	5 7 1/8	17 5 3/8
4 7 1/4	14 4 1/8	4 10 1/4	15 1 1/2	5 1 1/4	15 10 7/8	5 4 1/4	16 8 5/16	5 7 1/4	17 5 3/4
4 7 3/8	14 4 1/2	4 10 3/8	15 1 7/8	5 1 3/8	15 11 1/4	5 4 3/8	16 8 3/4	5 7 3/8	17 6 1/8
4 7 1/2	14 4 7/8	4 10 1/2	15 2 5/16	5 1 1/2	15 11 1/16	5 4 1/2	16 9 1/8	5 7 1/2	17 6 9/16
4 7 5/8	14 5 1/4	4 10 5/8	15 2 1/16	5 1 5/8	16 0 1/16	5 4 5/8	16 9 1/2	5 7 5/8	17 7
4 7 3/4	14 5 1/16	4 10 3/4	15 3 1/16	5 1 3/4	16 0 1/2	5 4 3/4	16 9 7/8	5 7 3/4	17 7 3/8
4 7 7/8	14 6 1/16	4 10 7/8	15 3 7/16	5 1 7/8	16 0 7/8	5 4 7/8	16 10 5/16	5 7 7/8	17 7 3/4
4 8	14 6 7/16	4 11	15 3 13/16	5 2	16 1 1/4	5 5	16 10 11/16	5 8	17 8 3/16
4 8 1/8	14 6 7/8	4 11 1/8	15 4 3/16	5 2 1/8	16 1 11/16	5 5 1/8	16 11 1/8	5 8 1/8	17 8 9/16
4 8 1/4	14 7 1/4	4 11 1/4	15 4 9/16	5 2 1/4	16 2 1/8	5 5 1/4	16 11 1/2	5 8 1/4	17 9
4 8 3/8	14 7 5/8	4 11 3/8	15 5	5 2 3/8	16 2 1/2	5 5 3/8	16 11 7/8	5 8 3/8	17 9 3/8
4 8 1/2	14 8	4 11 1/2	15 5 7/16	5 2 1/2	16 2 7/8	5 5 1/2	17 0 5/16	5 8 1/2	17 9 3/4
4 8 5/8	14 8 3/8	4 11 5/8	15 5 13/16	5 2 5/8	16 3 1/4	5 5 5/8	17 0 11/16	5 8 5/8	17 10 1/8
4 8 3/4	14 8 13/16	4 11 3/4	15 6 3/16	5 2 3/4	16 3 5/8	5 5 3/4	17 1 1/16	5 8 3/4	17 10 1/2
4 8 7/8	14 9 3/16	4 11 7/8	15 6 9/16	5 2 7/8	16 4	5 5 7/8	17 1 7/16	5 8 7/8	17 10 7/8
4 9	14 9 9/16	5 0	15 7	5 3	16 4 7/16	5 6	17 1 13/16	5 9	17 11 1/4
4 9 1/8	14 10	5 0 1/8	15 7 3/8	5 3 1/8	16 4 7/8	5 6 1/8	17 2 1/4	5 9 1/8	17 11 5/8
4 9 1/4	14 10 3/8	5 0 1/4	15 7 3/4	5 3 1/4	16 5 1/4	5 6 1/4	17 2 5/8	5 9 1/4	18 0
4 9 3/8	14 10 3/4	5 0 3/8	15 8 1/8	5 3 3/8	16 5 5/8	5 6 3/8	17 3	5 9 3/8	18 0 3/8
4 9 1/2	14 11 1/8	5 0 1/2	15 8 9/16	5 3 1/2	16 6	5 6 1/2	17 3 7/16	5 9 1/2	18 0 13/16
4 9 5/8	14 11 1/2	5 0 5/8	15 9	5 3 5/8	16 6 3/8	5 6 5/8	17 3 13/16	5 9 5/8	18 1 1/4
4 9 3/4	14 11 7/8	5 0 3/4	15 9 3/8	5 3 3/4	16 6 3/4	5 6 3/4	17 4 3/16	5 9 3/4	18 1 5/8
4 9 7/8	15 0 1/4	5 0 7/8	15 9 3/4	5 3 7/8	16 7 1/8	5 6 7/8	17 4 9/16	5 9 7/8	18 2

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ½ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft	in.	ft.	in	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
5	10	18	$2\frac{7}{16}$	6	1	18	$11\frac{7}{8}$	6	4	19	$9\frac{1}{4}$	6	7	20	$6\frac{11}{16}$	6	10	21	$4\frac{1}{8}$
5	$10\frac{1}{8}$	18	$2\frac{7}{8}$	6	$1\frac{1}{8}$	19	$0\frac{1}{4}$	6	$4\frac{1}{8}$	19	$9\frac{5}{8}$	6	$7\frac{1}{8}$	20	$7\frac{1}{8}$	6	$10\frac{1}{8}$	21	$4\frac{1}{2}$
5	$10\frac{1}{4}$	18	$3\frac{1}{4}$	6	$1\frac{1}{4}$	19	$0\frac{5}{8}$	6	$4\frac{1}{4}$	19	10	6	$7\frac{1}{4}$	20	$7\frac{1}{2}$	6	$10\frac{1}{4}$	21	$4\frac{7}{8}$
5	$10\frac{3}{8}$	18	$3\frac{5}{8}$	6	$1\frac{3}{8}$	19	1	6	$4\frac{3}{8}$	19	$10\frac{3}{8}$	6	$7\frac{3}{8}$	20	$7\frac{7}{8}$	6	$10\frac{3}{8}$	21	$5\frac{1}{4}$
5	$10\frac{1}{2}$	18	4	6	$1\frac{1}{2}$	19	$1\frac{7}{16}$	6	$4\frac{1}{2}$	19	$10\frac{13}{16}$	6	$7\frac{1}{2}$	20	$8\frac{1}{4}$	6	$10\frac{1}{2}$	21	$5\frac{11}{16}$
5	$10\frac{5}{8}$	18	$4\frac{3}{8}$	6	$1\frac{5}{8}$	19	$1\frac{13}{16}$	6	$4\frac{5}{8}$	19	$11\frac{1}{4}$	6	$7\frac{5}{8}$	20	$8\frac{5}{8}$	6	$10\frac{5}{8}$	21	$6\frac{1}{16}$
5	$10\frac{3}{4}$	18	$4\frac{7}{8}$	6	$1\frac{3}{4}$	19	$2\frac{3}{16}$	6	$4\frac{3}{4}$	19	$11\frac{5}{8}$	6	$7\frac{3}{4}$	20	9	6	$10\frac{3}{4}$	21	$6\frac{1}{2}$
5	$10\frac{7}{8}$	18	$5\frac{1}{4}$	6	$1\frac{7}{8}$	19	$2\frac{9}{16}$	6	$4\frac{7}{8}$	20	0	6	$7\frac{7}{8}$	20	$9\frac{7}{16}$	6	$10\frac{7}{8}$	21	$6\frac{7}{8}$
5	11	18	$5\frac{5}{8}$	6	2	19	3	6	5	20	$0\frac{7}{16}$	6	8	20	$9\frac{13}{16}$	6	11	21	$7\frac{1}{4}$
5	$11\frac{1}{8}$	18	6	6	$2\frac{1}{8}$	19	$3\frac{3}{8}$	6	$5\frac{1}{8}$	20	$0\frac{13}{16}$	6	$8\frac{1}{8}$	20	$10\frac{1}{4}$	6	$11\frac{1}{8}$	21	$7\frac{5}{8}$
5	$11\frac{1}{4}$	18	$6\frac{3}{8}$	6	$2\frac{1}{4}$	19	$3\frac{3}{4}$	6	$5\frac{1}{4}$	20	$1\frac{3}{16}$	6	$8\frac{1}{4}$	20	$10\frac{5}{8}$	6	$11\frac{1}{4}$	21	8
5	$11\frac{3}{8}$	18	$6\frac{3}{4}$	6	$2\frac{3}{8}$	19	$4\frac{1}{8}$	6	$5\frac{3}{8}$	20	$1\frac{9}{16}$	6	$8\frac{3}{8}$	20	11	6	$11\frac{3}{8}$	21	$8\frac{3}{8}$
5	$11\frac{1}{2}$	18	$7\frac{1}{8}$	6	$2\frac{1}{2}$	19	$4\frac{9}{16}$	6	$5\frac{1}{2}$	20	2	6	$8\frac{1}{2}$	20	$11\frac{3}{8}$	6	$11\frac{1}{2}$	21	$8\frac{13}{16}$
5	$11\frac{5}{8}$	18	$7\frac{1}{2}$	6	$2\frac{5}{8}$	19	5	6	$5\frac{5}{8}$	20	$2\frac{3}{8}$	6	$8\frac{5}{8}$	20	$11\frac{3}{4}$	6	$11\frac{5}{8}$	21	$9\frac{1}{4}$
5	$11\frac{3}{4}$	18	$7\frac{7}{8}$	6	$2\frac{3}{4}$	19	$5\frac{3}{8}$	6	$5\frac{3}{4}$	20	$2\frac{3}{4}$	6	$8\frac{3}{4}$	21	$0\frac{1}{8}$	6	$11\frac{3}{4}$	21	$9\frac{5}{8}$
5	$11\frac{7}{8}$	18	$8\frac{1}{4}$	6	$2\frac{7}{8}$	19	$5\frac{3}{4}$	6	$5\frac{7}{8}$	20	$3\frac{1}{8}$	6	$8\frac{7}{8}$	21	$0\frac{1}{2}$	6	$11\frac{7}{8}$	21	10
6	0	18	$8\frac{11}{16}$	6	3	19	$6\frac{1}{8}$	6	6	20	$3\frac{1}{2}$	6	9	21	$0\frac{7}{8}$	7	0	21	$10\frac{3}{8}$
6	$0\frac{1}{8}$	18	$9\frac{1}{8}$	6	$3\frac{1}{8}$	19	$6\frac{1}{2}$	6	$6\frac{1}{8}$	20	$3\frac{7}{8}$	6	$9\frac{1}{8}$	21	$1\frac{5}{16}$	7	$0\frac{1}{8}$	21	$10\frac{3}{4}$
6	$0\frac{1}{4}$	18	$9\frac{1}{2}$	6	$3\frac{1}{4}$	19	$6\frac{7}{8}$	6	$6\frac{1}{4}$	20	$4\frac{5}{16}$	6	$9\frac{1}{4}$	21	$1\frac{3}{4}$	7	$0\frac{1}{4}$	21	$11\frac{1}{8}$
6	$0\frac{3}{8}$	18	$9\frac{7}{8}$	6	$3\frac{3}{8}$	19	$7\frac{1}{4}$	6	$6\frac{3}{8}$	20	$4\frac{11}{16}$	6	$9\frac{3}{8}$	21	$2\frac{1}{8}$	7	$0\frac{3}{8}$	21	$11\frac{1}{2}$
6	$0\frac{1}{2}$	18	$10\frac{5}{16}$	6	$3\frac{1}{2}$	19	$7\frac{11}{16}$	6	$6\frac{1}{2}$	20	$5\frac{1}{16}$	6	$9\frac{1}{2}$	21	$2\frac{1}{2}$	7	$0\frac{1}{2}$	21	$11\frac{7}{8}$
6	$0\frac{5}{8}$	18	$10\frac{11}{16}$	6	$3\frac{5}{8}$	19	$8\frac{1}{8}$	6	$6\frac{5}{8}$	20	$5\frac{1}{2}$	6	$9\frac{5}{8}$	21	$2\frac{7}{8}$	7	$0\frac{5}{8}$	22	$0\frac{5}{16}$
6	$0\frac{3}{4}$	18	$11\frac{1}{8}$	6	$3\frac{3}{4}$	19	$8\frac{1}{2}$	6	$6\frac{3}{4}$	20	$5\frac{7}{8}$	6	$9\frac{3}{4}$	21	$3\frac{5}{16}$	7	$0\frac{3}{4}$	22	$0\frac{3}{4}$
6	$0\frac{7}{8}$	18	$11\frac{1}{2}$	6	$3\frac{7}{8}$	19	$8\frac{7}{8}$	6	$6\frac{7}{8}$	20	$6\frac{1}{4}$	6	$9\frac{7}{8}$	21	$3\frac{11}{16}$	7	$0\frac{7}{8}$	22	$1\frac{1}{8}$

TABLE OF CIRCUMFERENCES OF CIRCLES OF PLATE ½ IN. THICK, from 10 in. Diameter to 8 ft. Diameter—*continued*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	1	22	1½	7	4	22	10⅞	7	7	23	8⅜	7	10	24	5 13/16
7	1⅛	22	1⅞	7	4⅛	22	11 5/16	7	7⅛	23	8¾	7	10⅛	24	6¼
7	1¼	22	2 5/16	7	4¼	22	11¾	7	7¼	23	9⅛	7	10¼	24	6⅝
7	1⅜	22	2 11/16	7	4⅜	23	0⅛	7	7⅜	23	9 9/16	7	10⅜	24	7
7	1½	22	3⅛	7	4½	23	0½	7	7½	23	10	7	10½	24	7⅜
7	1⅝	22	3½	7	4⅝	23	0⅞	7	7⅝	23	10⅜	7	10⅝	24	7¾
7	1¾	22	3⅞	7	4¾	23	1 5/16	7	7¾	23	10¾	7	10¾	24	8⅛
7	1⅞	22	4¼	7	4⅞	23	1 11/16	7	7⅞	23	11⅛	7	10⅞	24	8½
7	2	22	4 11/16	7	5	23	2 1/16	7	8	23	11½	7	11	24	8⅞
7	2⅛	22	5⅛	7	5⅛	23	2 7/16	7	8⅛	23	11⅞	7	11⅛	24	9¼
7	2¼	22	5½	7	5¼	23	2 13/16	7	8¼	24	0¼	7	11¼	24	9 11/16
7	2⅜	22	5⅞	7	5⅜	23	3⅛	7	8⅜	24	0 11/16	7	11⅜	24	10⅛
7	2½	22	6¼	7	5½	23	3 9/16	7	8½	24	1 1/16	7	11½	24	10½
7	2⅝	22	6 11/16	7	5⅝	23	4	7	8⅝	24	1½	7	11⅝	24	10⅞
7	2¾	22	7 1/16	7	5¾	23	4 7/16	7	8¾	24	1⅞	7	11¾	24	11¼
7	2⅞	22	7 7/16	7	5⅞	23	4⅞	7	8⅞	24	2¼	7	11⅞	24	11 11/16
7	3	22	7 13/16	7	6	23	5¼	7	9	24	2 11/16	8	0	25	0 1/16
7	3⅛	22	8⅛	7	6⅛	23	5⅝	7	9⅛	24	3 1/16	8	0⅛	25	0½
7	3¼	22	8½	7	6¼	23	6	7	9¼	24	3 7/16	8	0¼	25	0⅞
7	3⅜	22	8⅞	7	6⅜	23	6 7/16	7	9⅜	24	3 13/16	8	0⅜	25	1¼
7	3½	22	9 5/16	7	6½	23	6 13/16	7	9½	24	4 3/16	8	0½	25	1 11/16
7	3⅝	22	9¾	7	6⅝	23	7¼	7	9⅝	24	4 9/16	8	0⅝	25	2 1/16
7	3¾	22	10⅛	7	6¾	23	7⅝	7	9¾	24	5	8	0¾	25	2 7/16
7	3⅞	22	10½	7	6⅞	23	8	7	9⅞	24	5⅜	8	0⅞	25	2 13/16

On Punching, &c.

A punched hole is always conical; and in punching plates care should be taken that the small sides of the holes come together when lapped, see Fig. 4, otherwise the rivet will not properly fill the hole, as in Fig. 5. When the boiler is made in alternate inside and outside rings of plates, and not lapped telescopically, all that need be done is to turn over each plate when both sides and one end are punched, and punch the remaining end on the reverse side; but if the

Fig. 4.

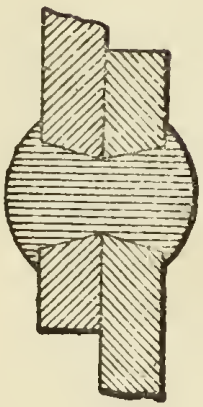
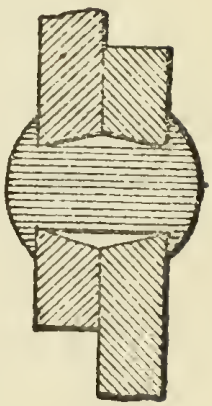


Fig. 5.



boiler is lapped telescopically, viz. one side of the plates inside and the other outside lap, one side and one end of each plate should be punched on one side, and the remaining side and end on the other side, except the back-end tier, which should be 2-in. pitch all over, and punched according to the first rule. The plates for the tubes should be punched exactly the same way. All holes should be punched to a line when possible, and the punch and die, or bolster, should be sharp

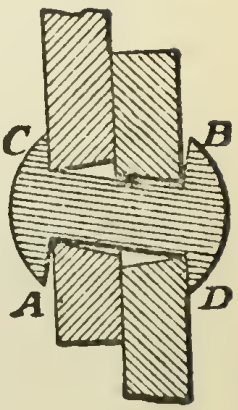
at the edges and well-fitting. Never work with the punch or die loose.

On Thinning Corners.

It is important that the corners of the plates should be carefully thinned, and drawn in the direction of the plate that is to cover them; they should be thinned sufficiently far back not to leave a little hole between the two plates that come over and under them, or the caulker will have to drive a little wedge in, which is a thing to be avoided; be careful not to split the corners in thinning, or they will probably break in setting. After the corner is thinned, it will of course be too wide one way; it should not, however, be cut off with the hot-set, but left for the caulker to cut according to his own requirements: do not hammer the corner until it becomes cold, but thin it out quickly and lay it down while hot.

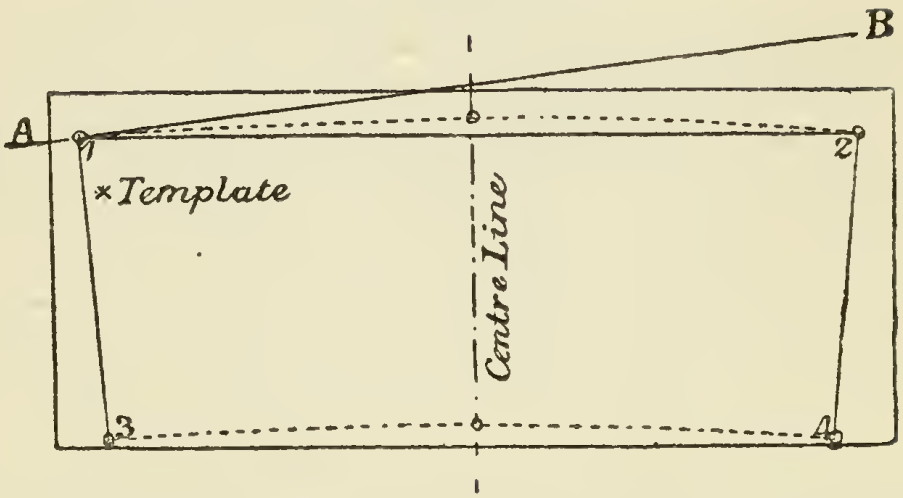
Before proceeding further, we will again call attention to the importance of having the small sides of the holes made to come together as in Fig. 4, page 65, and not as shown at Fig. 5. If the plates are wrongly lapped they will slide over each other when the boiler is under pressure, and when the pressure is removed they will resume their former position, see Fig. 6. It will be observed here that the edge of the rivet has left the plate at A and B. This is exactly what does occur, and it clearly accounts for a circumstance

Fig. 6.



that often puzzles the caulker, viz., that a boiler made perfectly tight at a pressure of say 100 pounds per square inch will again commence leaking if the pressure is removed and again applied. It will be readily understood that if the edges of the rivet A and B are caulked down to the plate, they will be again pushed back, and the edges C and D thrown open upon the plate being forced into its original position (Fig. 5). This will probably occur as many times as the boiler is subjected to pressure; until the caulker is driven to acknowledge, in despair, that the more he caulks the rivets the worse they become; and the purchaser, if present, is got rid of by some such excuse as that they will soon "take up," that all new boilers leak a little (which is not true), and so on. The plates of a boiler or flue lapped telescopically should be made with a camber or a curved edge; and the way to ascertain the proper camber is as follows:—refer to the Table of circumferences of circles of

Fig. 7



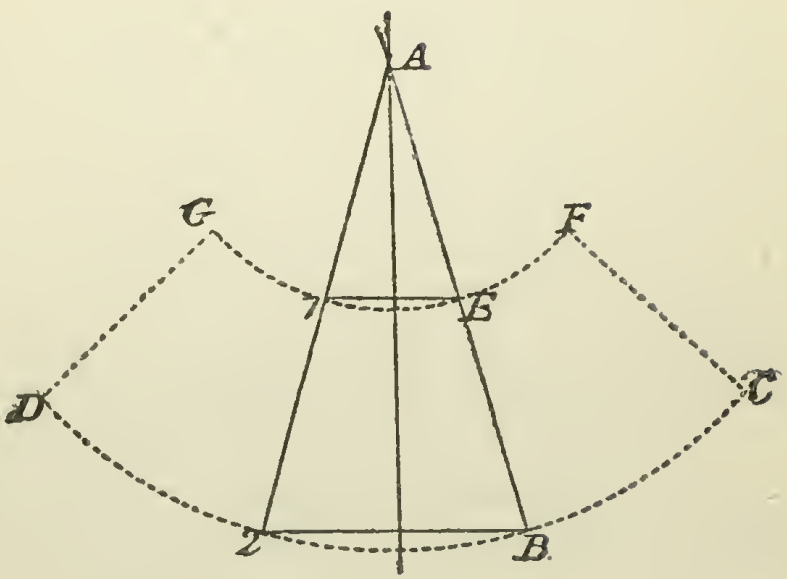
* The number of plates in the circumference of the boiler do not affect this rule, the camber is constructed the same way, whether for one or any number of plates.

plate of the thickness wanted, and see what lengths the long and short edges must be; then mark these distances on the plate, as 1, 2, 3, 4. Draw a line from 1 to 2 and from 1 to 3, then form the line A B at right angles with the line 1, 3, and half the distance on the centre line between A B and 1, 2 will be the rise of camber. The curved line 3, 4 should be an equal distance from the curved line 1, 2 all along its length. Mark all the holes 2-in. pitch on the long line, which will come in exactly if you work to the instructions on the preceding pages, and then divide the same number of holes on the short line with a pair of spring dividers.

To strike out a Plate for Conical-end of Tube, Galloway Pipe, ordinary Bucket, &c.

First draw the shape of the thing you want to make; then draw a centre line, and continue the side lines until they meet in the centre at A.

Fig. 8.



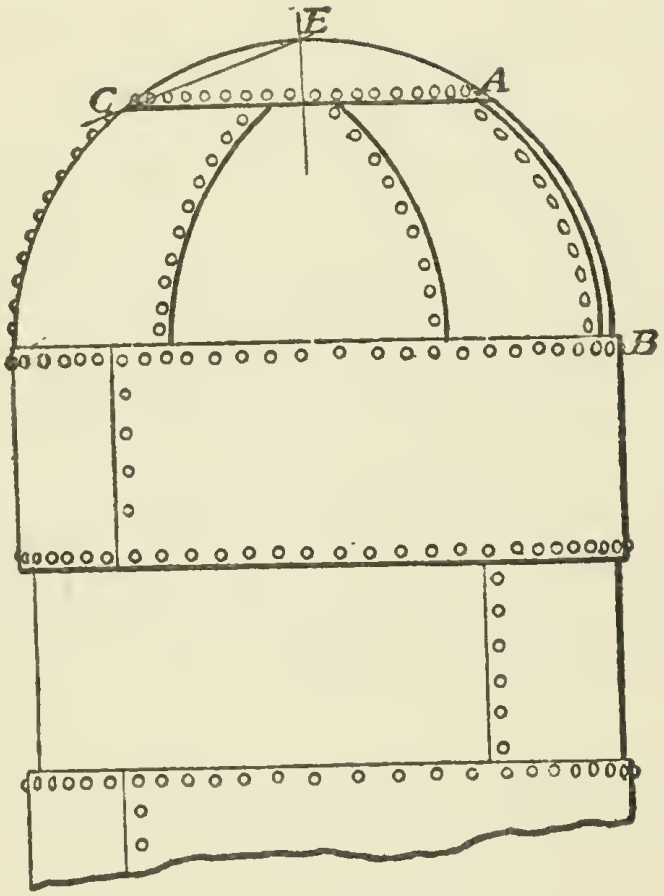
Extend your compasses, and with A as a centre, draw the curved line C B D; then set the compasses from A to E, and draw the line F E G. Look in the table of circumferences for the amount of material required for the large and small diameters, and after measuring from the centre each way on the curved lines, draw the lines F C, G D. The plain lines in the diagram 1, 2, B E, are the finished size of the article required, and the dotted lines form the development of plate for making the same.

Instructions for making Templates of Egg- or Hemispherical-ended Boilers, Sugar Pans, &c.

The radius of the egg-end should be the same as the boiler, viz., if the boiler is 5 ft. diameter, set the compass to 2 ft. 6 in. and describe half a circle. Then work the compasses round the half-circle without altering them, which will divide it into three equal parts, as shown on the diagram from B to A, from A to C, and from C to D. These letters show the position of the joint-holes, and also that the crown plate is one-third of the egg-end. Now mark the crown plate for punching, which is simply done by setting the compasses from the joint-hole C, to the centre of the crown plate in a straight line. Do not fall into the error of measuring the curved line, but set the compasses straight, as the line C E. With this radius make a circle on a flat plate, and divide this circle into as many parts as there are to be plates in the egg-end. If six, which is the usual

number, work the compasses round without altering them, which will divide it exactly, marking

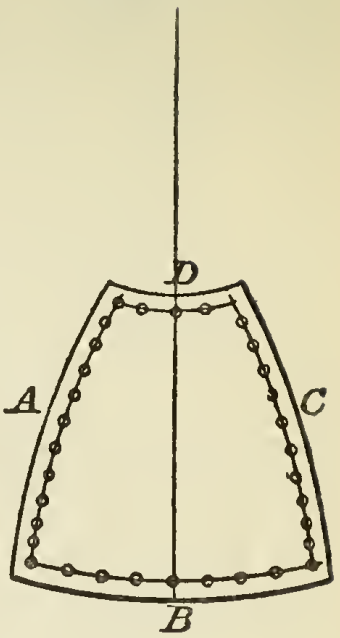
Fig. 9



the six joint-holes. Then mark as many holes as you have room for between every two joint-holes, as near 2-inch pitch as you can get them. Keep the centres of all the holes on the line. This plate is now ready for punching, dishing, &c. To mark out the taper plates of the egg-end proceed thus:—First draw a long straight line, then set your compasses or trammel to once and a-half the diameter of the boiler; that is to say, if the boiler is 5 ft. diameter, set the trammel to 7 ft. 6 in., and with this radius mark the three sides A B C. The length of the side B from centre

to centre of corner holes, measured with the curve along the centre of the holes, should be equal to one-sixth the circumference of the boiler. Look at the diagram on page 70, and you will see a double line on the right side: and if you wish to be absolutely accurate, let the length of the line C, on this figure, be from centre to centre of corner holes equal to the outer line measured with the curve; but it is sufficiently correct to take one-sixth the circumference of the boiler as the length of the lines A B C, but take care to have the inside-lap the thickness of the plate shorter than the outside lap. For the radius of the small end D, set the trammel to once and a-half the radius of the crown plate, which will give the radius of the small end D. Let the length of the line be the thickness of the plate, less than one of the six divisions of the crown plate. If there are seven, or any other number of plates in the egg-end, the same radii must be used; but of course the length of the lines B and D must be the one-seventh instead of the sixth of the circumference of the crown plate and shell, &c.

Fig. 10.

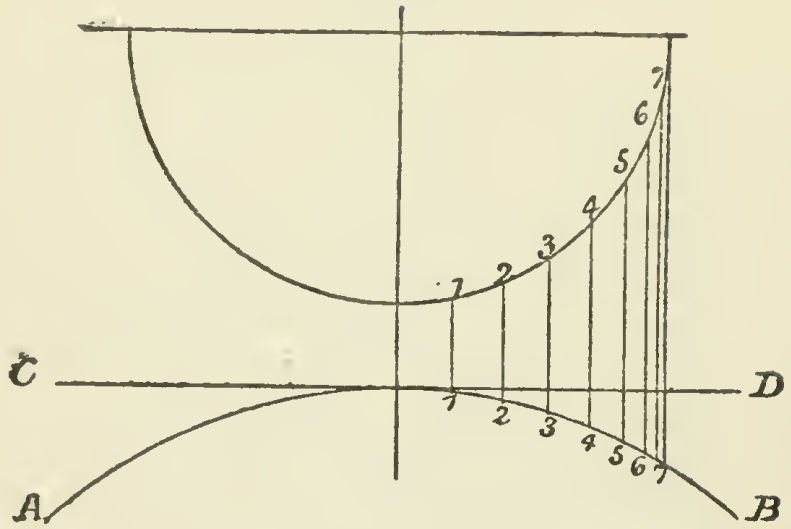


Instructions for Cutting-out Curves of Bottoms of Steam Chests, &c.

There are two methods of doing this; the most accurate, although much the slowest, is accom-

plished thus. First strike out with a trammel a part of the top of the boiler, full-size, as the line

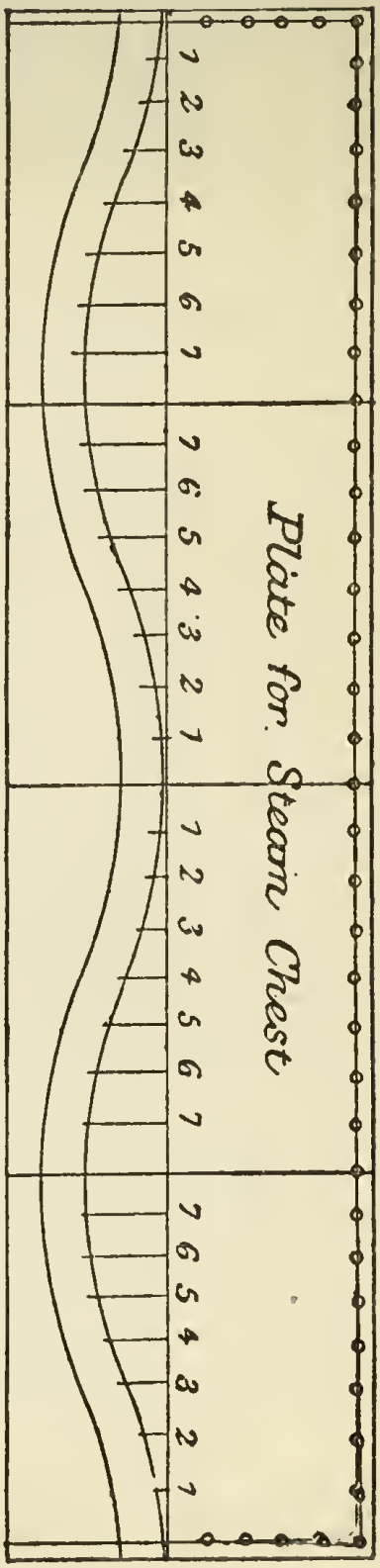
Fig. 11.



A B, and on it erect two vertical lines representing the sides of steam-chest; then describe part of circle the same size as steam-chest, and divide one-quarter into any number of equal parts, as in the accompanying sketch, and from these divisions draw lines parallel with the sides of the steam-chest, and touching the top of the boiler, and through these lines draw a horizontal line, touching the top of the boiler, as the line C D. Now take the plate that is to form the steam-chest and divide it into four equal parts; and again, divide each of these four parts into as many as you have got lines in the quarter of the circle, taking care to number the lines until you become familiar with this operation. Next draw a line along the plate representing the distance from the top of the steam-chest to the top of the boiler in the centre, and corresponding with the line C D, on the diagram. Now mark on each of the subdivisions

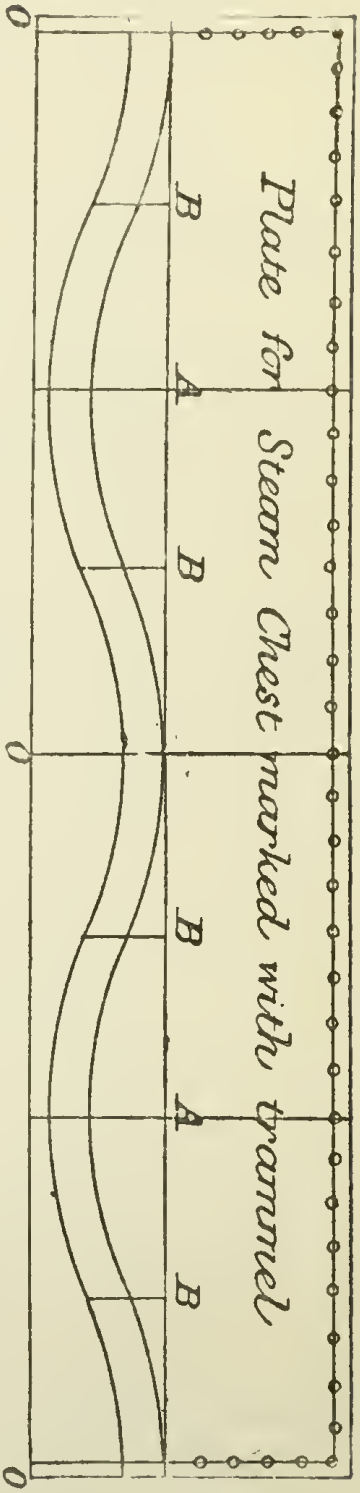
the distance on its corresponding number, from the line C D to the top of the boiler, as shown on the diagram; and if you have a steady hand, you may draw a line from mark to mark along the plate; or take a thin batten, bend it to the marks, and then draw your line with a piece of chalk, &c. Upon the same principle you may cut out the slopes at the bottoms of the backs of marine boilers, or the overhang of the fronts, or any distance-pieces between two cylindrical bodies. The second method of cutting out steam-chest curves is by far the quickest and most simple, and upon it are constructed the following Tables; but if the diameter of the steam-chest is much more than half the diameter of the boiler, this method will not be sufficiently accurate; but up to that proportion it is perfectly reliable. It is thus; first take the steam-chest plate and punch one side, and part of both ends; divide the plate into four equal parts, and draw a line

Fig. 12.



representing the top of the boiler, as in the previous case. From this line, draw one short line in the centre of each of the four divisions, as B B B B. Call the centre of the plate, and the two ends, O, and the remaining two lines A. Mark on the lines A the distance from the level of the top of the boiler, to the bottom of the side of the steam-chest, and on the lines B, half that distance. Extend the trammel to any radius that by taking a continuation of the line A as a centre, will touch the marks on A and B, and with that radius form the curve from B to B through A, from B to B through O, and from B to O at the ends. From this curved line draw another one whatever breadth you want the flange, and it is ready for shearing. Supposing you want to strike or line out the development of a 2 ft. 9 in. steam-chest to fit a 6 ft. boiler. Instead of making a drawing to see what distance to put your marks at A and B, refer to Table of depth of curves

Fig. 13.



of steam-chests, and run your eye along the column headed diameter of steam-chest at 2 ft. 9 in. until it meets column headed 6 ft. boiler, where you will find $4\frac{1}{8}$ in. at A, and half that, viz. $2\frac{1}{16}$ in., at B. This will save all the time and trouble of drawing and measuring, and avoid the possibility of making a mistake.

DEPTH OF CURVES OF STEAM CHESTS. (See page 71 for Explanation.)

Diam. of Steam Chest.		8 ft. 0 in. Boiler.		7 ft. 9 in. Boiler.		7 ft. 6 in. Boiler.		7 ft. 3 in. Boiler.		7 ft. 0 in. Boiler.		6 ft. 9 in. Boiler.		6 ft. 6 in. Boiler.		6 ft. 3 in. Boiler.	
ft.	in.	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1	0	$\frac{3}{8}$	$\frac{3}{16}$	$\frac{3}{8}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{9}{16}$	$\frac{9}{32}$	$\frac{9}{16}$	$\frac{9}{32}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{5}{16}$
1	3	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$
1	6	$\frac{7}{8}$	$\frac{7}{16}$	$\frac{7}{8}$	$\frac{7}{16}$	$\frac{7}{8}$	$\frac{7}{16}$	1	$\frac{1}{2}$	1	$\frac{1}{2}$	$1\frac{1}{8}$	$\frac{9}{16}$	$1\frac{1}{8}$	$\frac{9}{16}$	$1\frac{1}{8}$	$\frac{9}{16}$
1	9	$1\frac{1}{8}$	$\frac{9}{16}$	$1\frac{1}{8}$	$\frac{9}{16}$	$1\frac{1}{8}$	$\frac{9}{16}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{5}{8}$	$\frac{13}{16}$	$1\frac{5}{8}$	$\frac{13}{16}$	$1\frac{5}{8}$	$\frac{13}{16}$
2	0	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{5}{8}$	$\frac{13}{16}$	$1\frac{3}{4}$	$\frac{7}{8}$	$1\frac{3}{4}$	$\frac{7}{8}$	$1\frac{3}{4}$	$\frac{7}{8}$	$1\frac{7}{8}$	$\frac{15}{16}$	$1\frac{7}{8}$	$\frac{15}{16}$	2	1
2	3	2	1	2	1	2	1	$2\frac{1}{8}$	$1\frac{1}{16}$	$2\frac{1}{8}$	$1\frac{1}{16}$	$2\frac{3}{8}$	$1\frac{3}{16}$	$2\frac{3}{8}$	$1\frac{3}{16}$	$2\frac{1}{2}$	$1\frac{1}{4}$
2	6	$2\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{5}{16}$	$2\frac{5}{8}$	$1\frac{5}{16}$	$2\frac{3}{4}$	$1\frac{3}{8}$	$2\frac{7}{8}$	$1\frac{7}{16}$	3	$1\frac{1}{2}$	$3\frac{1}{8}$	$1\frac{9}{16}$	$3\frac{1}{4}$	$1\frac{5}{8}$
2	9	3	$1\frac{1}{2}$	3	$1\frac{1}{2}$	$3\frac{1}{8}$	$1\frac{9}{16}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{5}{8}$	$1\frac{13}{16}$	$3\frac{3}{4}$	$1\frac{7}{8}$	$3\frac{7}{8}$	$1\frac{15}{16}$
3	0	$3\frac{5}{8}$	$1\frac{13}{16}$	$3\frac{5}{8}$	$1\frac{13}{16}$	$3\frac{5}{8}$	$1\frac{13}{16}$	4	2	4	2	$4\frac{1}{2}$	$2\frac{1}{8}$	$4\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{5}{8}$	$2\frac{5}{16}$
3	3	$4\frac{1}{4}$	$2\frac{1}{8}$	$4\frac{1}{4}$	$2\frac{1}{8}$	$4\frac{1}{4}$	$2\frac{1}{8}$	$4\frac{5}{8}$	$2\frac{5}{16}$	$4\frac{3}{4}$	$2\frac{3}{8}$	5	$2\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{5}{8}$	$5\frac{1}{2}$	$2\frac{3}{4}$
3	6	$4\frac{7}{8}$	$2\frac{7}{16}$	5	$2\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{5}{8}$	$5\frac{3}{8}$	$2\frac{11}{16}$	$5\frac{7}{8}$	$2\frac{15}{16}$	6	3	$6\frac{1}{2}$	$3\frac{1}{4}$	$6\frac{3}{4}$	$3\frac{3}{8}$
3	9	$5\frac{3}{4}$	$2\frac{7}{8}$	$5\frac{7}{8}$	$2\frac{15}{16}$	$6\frac{1}{8}$	$3\frac{1}{16}$	$6\frac{1}{4}$	$3\frac{1}{8}$	$6\frac{3}{4}$	$3\frac{3}{8}$	7	$3\frac{1}{2}$				
4	0	$6\frac{5}{8}$	$3\frac{5}{16}$	$6\frac{3}{4}$	$3\frac{3}{8}$	7	$3\frac{1}{2}$	$7\frac{1}{4}$	$3\frac{5}{8}$	$7\frac{1}{2}$	$3\frac{3}{4}$						
4	3	$7\frac{1}{2}$	$3\frac{3}{4}$	$7\frac{3}{4}$	$3\frac{7}{8}$												
4	6	$8\frac{1}{2}$	$4\frac{1}{4}$	$8\frac{3}{4}$	$4\frac{3}{8}$												

DEPTH OF CURVES OF STEAM CHESTS—*continued.* (See page 71 for Explanation.)

Diam. of Steam Chests.		6 ft.0 in. Boiler.		5 ft.9 in. Boiler.		5 ft.6 in. Boiler.		5 ft.3 in. Boiler.		5 ft.0 in. Boiler.		4 ft.9 in. Boiler.		4 ft.6 in. Boiler.		4 ft.3 in. Boiler.	
ft.	in.	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1	0	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{5}{8}$	$\frac{5}{16}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{7}{8}$	$\frac{7}{16}$
1	3	$\frac{3}{4}$	$\frac{3}{8}$	$\frac{7}{8}$	$\frac{7}{16}$	$\frac{7}{8}$	$\frac{7}{16}$	1	$\frac{1}{2}$	1	$\frac{1}{2}$	1	$\frac{1}{2}$	1	$\frac{1}{2}$	$1\frac{1}{4}$	$\frac{5}{8}$
1	6	$1\frac{1}{4}$	$\frac{5}{8}$	$1\frac{1}{4}$	$\frac{5}{8}$	$1\frac{3}{8}$	$\frac{11}{16}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{3}{4}$	$\frac{7}{8}$
1	9	$1\frac{5}{8}$	$\frac{13}{16}$	$1\frac{3}{4}$	$\frac{7}{8}$	$1\frac{7}{8}$	$\frac{15}{16}$	$1\frac{7}{8}$	$\frac{15}{16}$	2	1	$2\frac{1}{8}$	$1\frac{1}{16}$	$2\frac{1}{4}$	$1\frac{1}{8}$	$2\frac{3}{8}$	$1\frac{3}{16}$
2	0	$2\frac{1}{8}$	$1\frac{1}{16}$	$2\frac{1}{4}$	$1\frac{1}{8}$	$2\frac{3}{8}$	$1\frac{3}{16}$	$2\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{5}{16}$	$2\frac{3}{4}$	$1\frac{3}{8}$	3	$1\frac{1}{2}$	$3\frac{1}{8}$	$1\frac{9}{16}$
2	3	$2\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{7}{8}$	$1\frac{7}{16}$	3	$1\frac{1}{2}$	$3\frac{1}{8}$	$1\frac{9}{16}$	$3\frac{1}{4}$	$1\frac{5}{8}$	$3\frac{3}{8}$	$1\frac{11}{16}$	$3\frac{5}{8}$	$1\frac{13}{16}$	4	2
2	6	$3\frac{1}{4}$	$1\frac{5}{8}$	$3\frac{5}{8}$	$1\frac{13}{16}$	$3\frac{3}{4}$	$1\frac{7}{8}$	$3\frac{7}{8}$	$1\frac{15}{16}$	$4\frac{1}{8}$	$2\frac{1}{16}$	$4\frac{1}{4}$	$2\frac{1}{8}$	$4\frac{1}{2}$	$2\frac{1}{4}$		
2	9	$4\frac{1}{8}$	$2\frac{1}{16}$	$4\frac{3}{8}$	$2\frac{3}{16}$	$4\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{3}{4}$	$2\frac{3}{8}$	5	$2\frac{1}{2}$						
3	0	$4\frac{3}{4}$	$2\frac{3}{8}$	$5\frac{1}{8}$	$2\frac{9}{16}$	$5\frac{3}{8}$	$2\frac{11}{16}$										
3	3	$5\frac{3}{4}$	$2\frac{7}{8}$	$6\frac{1}{4}$	$3\frac{1}{8}$												
3	6	$6\frac{3}{4}$	$3\frac{3}{8}$														

Diam. of Steam Chests.		4 ft.0 in. Boiler.		3 ft.9 in. Boiler.		3 ft.6 in. Boiler.		3 ft.3 in. Boiler.		3 ft.0 in. Boiler.		2 ft.9 in. Boiler.		2 ft.6 in. Boiler.		2 ft.3 in. Boiler.	
ft.	in.	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1	0	$\frac{7}{8}$	$\frac{7}{16}$	$\frac{7}{8}$	$\frac{7}{16}$	$\frac{7}{8}$	$\frac{7}{16}$	1	$\frac{1}{2}$	1	$\frac{1}{2}$	$1\frac{1}{8}$	$\frac{9}{16}$	$1\frac{1}{4}$	$\frac{5}{8}$	$1\frac{1}{2}$	$\frac{3}{4}$
1	3	$1\frac{3}{8}$	$\frac{11}{16}$	$1\frac{3}{8}$	$\frac{11}{16}$	$1\frac{1}{2}$	$\frac{3}{4}$	$1\frac{5}{8}$	$\frac{13}{16}$	$1\frac{5}{8}$	$\frac{13}{16}$	$1\frac{3}{4}$	$\frac{7}{8}$	2	1	$2\frac{1}{4}$	$1\frac{1}{8}$
1	6	$1\frac{3}{4}$	$\frac{7}{8}$	$1\frac{7}{8}$	$\frac{15}{16}$	2	1	$2\frac{1}{4}$	$1\frac{1}{8}$	$2\frac{1}{2}$	$1\frac{1}{4}$	$2\frac{7}{8}$	$1\frac{7}{16}$	$3\frac{1}{8}$	$1\frac{9}{16}$	$3\frac{5}{8}$	$1\frac{13}{16}$
1	9	$2\frac{1}{8}$	$1\frac{1}{4}$	$2\frac{5}{8}$	$1\frac{5}{16}$	$2\frac{7}{8}$	$1\frac{7}{16}$	$3\frac{1}{4}$	$1\frac{5}{8}$	$3\frac{1}{2}$	$1\frac{3}{4}$	4	2	$4\frac{1}{2}$	$2\frac{1}{4}$		
2	0	$3\frac{1}{4}$	$1\frac{5}{8}$	$3\frac{1}{2}$	$1\frac{3}{4}$	$3\frac{7}{8}$	$1\frac{15}{16}$	$4\frac{1}{4}$	$2\frac{1}{8}$	$4\frac{1}{2}$	$2\frac{1}{4}$						
2	3	$4\frac{1}{8}$	$2\frac{1}{16}$	$4\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{7}{8}$	$2\frac{7}{16}$										

On Flanging, &c.

Bending the edge of a plate at an angle with the plate is called flanging it, and the size or width of flange depends upon the thickness of plate and size of rivets to be used. A 3-in. flange is the most common size. A plate during the process of flanging will gain twice its thickness in length in each flange. Thus, suppose you want to flange a circular plate to have a 3-in. flange all round, and to be 3 ft. diameter after being flanged, and $\frac{3}{8}$ in. thick, you must not add twice the width of flange to the diameter, making 3 ft. 6 in., but twice the width of flange, less four times the thickness, making 3 ft. $4\frac{1}{2}$ in. In marking the plate-line out the exact diameter you want it to be after being flanged, then allow the width of flange less twice the thickness: and when flanged the centre marks should be on the flange just where the curve joins the flat The proper radius of the bend or root of a flange is twice and one-eighth the thickness of the plate for the outside curve. In heating the plate to be flanged, especially if it is a difficult one, confine your heat to as little as possible over the width of the flange, but take as long a heat as you can. To do this as it should be done make your fire the shape of the plate to be flanged. This is easily accomplished by bending a piece of thin iron and packing the coal (well wetted and mixed like mortar) up to it on the forge, or by adjusting a few fire-bricks to the required shape. Keep the centre of your fire always clean; do not allow dust or clinker to accumulate there, but let it

consist of clean coke broken small, and the harder the better; if possible have a block or anvil to fit the flange, and do not, on any account, flange on a block with sharp edges. Finally, avoid having to alter a flange, always try to have it right at first.

Angle-iron Rings.

The greatest difficulty in making angle-iron rings is to ascertain the necessary amount of metal required Some persons add twice the thickness of the root of the bar to the diameter, and multiply by 3·1416 for external rings, and deduct twice the thickness before multiplying for internal ones, because, in making external rings, the bar becomes shorter, and in making internal ones it becomes longer Another rule is to add twice the width of flange to the circumference, or deduct it, as the case may be, but neither rule is sufficiently correct to suit every section of flange. The following are Tables of length of bar required for 3 in $\times$ 3 in. $\times$ $\frac{1}{2}$ in. rings of ordinary section suitable for boiler-work, no allowance being made for lap or welding. Directions for welding angle-iron will be found in the chapter devoted specially to welding, commencing page 91.

Length of Bar required for 3 in. Angle-Iron Rings, External.

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
1 0	3 7⅝	1 3	4 5	1 6	5 2½	1 9	5 11⅞	2 0	6 9⅜
1 0⅛	3 8	1 3⅛	4 5½	1 6⅛	5 2⅞	1 9⅛	6 0⅜	2 0⅛	6 9¾
1 0¼	3 8⅜	1 3¼	4 5⅞	1 6¼	5 3¼	1 9¼	6 0¾	2 0¼	6 10⅛
1 0⅜	3 8⅞	1 3⅜	4 6¼	1 6⅜	5 3⅝	1 9⅜	6 1⅛	2 0⅜	6 10½
1 0½	3 9¼	1 3½	4 6⅝	1 6½	5 4	1 9½	6 1½	2 0½	6 10⅞
1 0⅝	3 9⅝	1 3⅝	4 7	1 6⅝	5 4⅜	1 9⅝	6 2	2 0⅝	6 11¼
1 0¾	3 10	1 3¾	4 7⅜	1 6¾	5 4⅞	1 9¾	6 2⅜	2 0¾	6 11¾
1 0⅞	3 10⅜	1 3⅞	4 7⅞	1 6⅞	5 5¼	1 9⅞	6 2¾	2 0⅞	7 0⅛
1 1	3 10¾	1 4	4 8¼	1 7	5 5⅝	1 10	6 3	2 1	7 0½
1 1⅛	3 11⅛	1 4⅛	4 8⅝	1 7⅛	5 6	1 10⅛	6 3½	2 1⅛	7 0⅞
1 1¼	3 11⅝	1 4¼	4 9	1 7¼	5 6⅜	1 10¼	6 3⅞	2 1¼	7 1¼
1 1⅜	4 0	1 4⅜	4 9⅜	1 7⅜	5 6⅞	1 10⅜	6 4¼	2 1⅜	7 1⅝
1 1½	4 0⅜	1 4½	4 9¾	1 7½	5 7¼	1 10½	6 4⅝	2 1½	7 2
1 1⅝	4 0¾	1 4⅝	4 10⅛	1 7⅝	5 7⅝	1 10⅝	6 5	2 1⅝	7 2½
1 1¾	4 1⅛	1 4¾	4 10½	1 7¾	5 8	1 10¾	6 5⅜	2 1¾	7 2⅞
1 1⅞	4 1½	1 4⅞	4 11	1 7⅞	5 8⅜	1 10⅞	6 5¾	2 1⅞	7 3¼
1 2	4 1⅞	1 5	4 11⅜	1 8	5 8¾	1 11	6 6¼	2 2	7 3⅝
1 2⅛	4 2⅜	1 5⅛	4 11¾	1 8⅛	5 9⅛	1 11⅛	6 6⅝	2 2⅛	7 4
1 2¼	4 2¾	1 5¼	5 0⅛	1 8¼	5 9⅝	1 11¼	6 7	2 2¼	7 4⅜
1 2⅜	4 3⅛	1 5⅜	5 0½	1 8⅜	5 10	1 11⅜	6 7⅜	2 2⅜	7 4¾
1 2½	4 3½	1 5½	5 0⅞	1 8½	5 10⅜	1 11½	6 7¾	2 2½	7 5⅛
1 2⅝	4 3⅞	1 5⅝	5 1⅜	1 8⅝	5 10¾	1 11⅝	6 8⅛	2 2⅝	7 5⅝
1 2¾	4 4¼	1 5¾	5 1¾	1 8¾	5 11⅛	1 11¾	6 8½	2 2¾	7 6
1 2⅞	4 4⅝	1 5⅞	5 2⅛	1 8⅞	5 11½	1 11⅞	6 9	2 2⅞	7 6⅜

Length of Bar required for 3 in. Angle-Iron Rings, External—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in	ft. in.	ft. in.	ft. in.
2 3	7 6¾	2 6	8 4⅛	2 9	9 1⅝	3 0	9 11	3 3	10 8½
2 3⅛	7 7⅛	2 6⅛	8 4⅝	2 9⅛	9 2	3 0⅛	9 11⅜	3 3⅛	10 8⅞
2 3¼	7 7½	2 6¼	8 5	2 9¼	9 2⅜	3 0¼	9 11⅞	3 3¼	10 9⅛
2 3⅜	7 8	2 6⅜	8 5⅜	2 9⅜	9 2¾	3 0⅜	10 0¼	3 3⅜	10 9⅝
2 3½	7 8⅜	2 6½	8 5¾	2 9½	9 3¼	3 0½	10 0⅝	3 3½	10 10
2 3⅝	7 8¾	2 6⅝	8 6⅛	2 9⅝	9 3⅝	3 0⅝	10 1	3 3⅝	10 10½
2 3¾	7 9⅛	2 6¾	8 6½	2 9¾	9 4	3 0¾	10 1⅜	3 3¾	10 10⅞
2 3⅞	7 9½	2 6⅞	8 6⅞	2 9⅞	9 4⅜	3 0⅞	10 1¾	3 3⅞	10 11¼
2 4	7 9⅞	2 7	8 7⅜	2 10	9 4¾	3 1	10 2⅛	3 4	10 11⅝
2 4⅛	7 10¼	2 7⅛	8 7¾	2 10⅛	9 5⅛	3 1⅛	10 2⅝	3 4⅛	11 0
2 4¼	7 10¾	2 7¼	8 8⅛	2 10¼	9 5½	3 1¼	10 3	3 4¼	11 0⅜
2 4⅜	7 11⅛	2 7⅜	8 8½	2 10⅜	9 5⅞	3 1⅜	10 3⅜	3 4⅜	11 0¾
2 4½	7 11½	2 7½	8 8⅞	2 10½	9 6⅜	3 1½	10 3¾	3 4½	11 1⅛
2 4⅝	7 11⅞	2 7⅝	8 9¼	2 10⅝	9 6¾	3 1⅝	10 4⅛	3 4⅝	11 1⅞
2 4¾	8 0¼	2 7¾	8 9¾	2 10¾	9 7⅛	3 1¾	10 4½	3 4¾	11 2
2 4⅞	8 0⅝	2 7⅞	8 10⅛	2 10⅞	9 7½	3 1⅞	10 4⅞	3 4⅞	11 2⅜
2 5	8 1	2 8	8 10½	2 11	9 7⅞	3 2	10 5⅜	3 5	11 2¾
2 5⅛	8 1½	2 8⅛	8 10⅞	2 11⅛	9 8¼	3 2⅛	10 5¾	3 5⅛	11 3⅛
2 5¼	8 1⅞	2 8¼	8 11¼	2 11¼	9 8⅝	3 2¼	10 6⅛	3 5¼	11 3½
2 5⅜	8 2¼	2 8⅜	8 11⅝	2 11⅜	9 9	3 2⅜	10 6½	3 5⅜	11 3⅞
2 5½	8 2⅝	2 8½	9 0	2 11½	9 9½	3 2½	10 6⅞	3 5½	11 4⅜
2 5⅝	8 3	2 8⅝	9 0½	2 11⅝	9 9⅞	3 2⅝	10 7¼	3 5⅝	11 4¾
2 5¾	8 3⅜	2 8¾	9 0⅞	2 11¾	9 10¼	3 2¾	10 7⅝	3 5¾	11 5⅛
2 5⅞	8 3¾	2 8⅞	9 1¼	2 11⅞	9 10⅝	3 2⅞	10 8⅛	3 5⅞	11 5½

Length of Bar required for 3 in. Angle-Iron Rings, External—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 6	11 5⅞	3 9	12 3¼	4 0	13 0¾	4 3	13 10⅛	4 6	14 7⅝
3 6⅛	11 6¼	3 9⅛	12 3¾	4 0⅛	13 1⅛	4 3⅛	13 10½	4 6⅛	14 8
3 6¼	11 6⅝	3 9¼	12 4⅛	4 0¼	13 1½	4 3¼	13 11	4 6¼	14 8⅜
3 6⅜	11 7⅛	3 9⅜	12 4½	4 0⅜	13 1⅞	4 3⅜	13 11⅜	4 6⅜	14 8¾
3 6½	11 7½	3 9½	12 4⅞	4 0½	13 2¼	4 3½	13 11¾	4 6½	14 9⅛
3 6⅝	11 7⅞	3 9⅝	12 5¼	4 0⅝	13 2¾	4 3⅝	14 0⅛	4 6⅝	14 9½
3 6¾	11 8¼	3 9¾	12 5⅝	4 0¾	13 3⅛	4 3¾	14 0½	4 6¾	14 10
3 6⅞	11 8⅝	3 9⅞	12 6	4 0⅞	13 3½	4 3⅞	14 0⅞	4 6⅞	14 10⅜
3 7	11 9	3 10	12 6½	4 1	13 3⅞	4 4	14 1¼	4 7	14 10¾
3 7⅛	11 9⅜	3 10⅛	12 6⅞	4 1⅛	13 4¼	4 4⅛	14 1¾	4 7⅛	14 11⅛
3 7¼	11 9⅞	3 10¼	12 7¼	4 1¼	13 4⅝	4 4¼	14 2⅛	4 7¼	14 11½
3 7⅜	11 10¼	3 10⅜	12 7⅝	4 1⅜	13 5	4 4⅜	14 2½	4 7⅜	14 11⅞
3 7½	11 10⅝	3 10½	12 8	4 1½	13 5½	4 4½	14 2⅞	4 7½	15 0¼
3 7⅝	11 11	3 10⅝	12 8⅜	4 1⅝	13 5⅞	4 4⅝	14 3¼	4 7⅝	15 0¾
3 7¾	11 11⅜	3 10¾	12 8¾	4 1¾	13 6¼	4 4¾	14 3⅝	4 7¾	15 1⅛
3 7⅞	11 11¾	3 10⅞	12 9¼	4 1⅞	13 6⅝	4 4⅞	14 4	4 7⅞	15 1½
3 8	12 0⅛	3 11	12 9⅝	4 2	13 7	4 5	14 4½	4 8	15 1⅞
3 8⅛	12 0½	3 11⅛	12 10	4 2⅛	13 7½	4 5⅛	14 4⅞	4 8⅛	15 2¼
3 8¼	12 1	3 11¼	12 10⅜	4 2¼	13 7⅞	4 5¼	14 5¼	4 8¼	15 2⅝
3 8⅜	12 1⅜	3 11⅜	12 10¾	4 2⅜	13 8¼	4 5⅜	14 5⅝	4 8⅜	15 3
3 8½	12 1¾	3 11½	12 11⅛	4 2½	13 8⅝	4 5½	14 6	4 8½	15 3½
3 8⅝	12 2⅛	3 11⅝	12 11½	4 2⅝	13 9	4 5⅝	14 6⅜	4 8⅝	15 3⅞
3 8¾	12 2½	3 11¾	13 0	4 2¾	13 9⅜	4 5¾	14 6⅞	4 8¾	15 4¼
3 8⅞	12 2⅞	3 11⅞	13 0⅜	4 2⅞	13 9¾	4 5⅞	14 7¼	4 8⅞	15 4⅝

Length of Bar required for 3 in. Angle-Iron Rings, External—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
4	9	15	5	5	0	16	2⅜	5	3	16	11⅞	5	6	17	9¼	5	9	18	6¾
4	9⅛	15	5⅜	5	0⅛	16	2⅞	5	3⅛	17	0¼	5	6⅛	17	9⅝	5	9⅛	18	7⅛
4	9¼	15	5¾	5	0¼	16	3¼	5	3¼	17	0⅝	5	6¼	17	10⅛	5	9¼	18	7½
4	9⅜	15	6⅛	5	0⅜	16	3⅝	5	3⅜	17	1	5	6⅜	17	10½	5	9⅜	18	7⅞
4	9½	15	6⅝	5	0½	16	4	5	3½	17	1⅜	5	6½	17	10⅞	5	9½	18	8¼
4	9⅝	15	7	5	0⅝	16	4⅜	5	3⅝	17	1⅞	5	6⅝	17	11¼	5	9⅝	18	8⅝
4	9¾	15	7⅜	5	0¾	16	4¾	5	3¾	17	2¼	5	6¾	17	11⅝	5	9¾	18	9
4	9⅞	15	7¾	5	0⅞	16	5⅛	5	3⅞	17	2⅝	5	6⅞	18	0	5	9⅞	18	9½
4	10	15	8⅛	5	1	16	5⅝	5	4	17	3	5	7	18	0⅜	5	10	18	9⅞
4	10⅛	15	8½	5	1⅛	16	6	5	4⅛	17	3⅜	5	7⅛	18	0⅞	5	10⅛	18	10¼
4	10¼	15	8⅞	5	1¼	16	6⅜	5	4¼	17	3¾	5	7¼	18	1¼	5	10¼	18	10⅝
4	10⅜	15	9⅜	5	1⅜	16	6¾	5	4⅜	17	4⅛	5	7⅜	18	1⅝	5	10⅜	18	11
4	10½	15	9¼	5	1½	16	7⅛	5	4½	17	4⅝	5	7½	18	2	5	10½	18	11⅜
4	10⅝	15	10⅛	5	1⅝	16	7½	5	4⅝	17	5	5	7⅝	18	2⅜	5	10⅝	18	11⅞
4	10¾	15	10½	5	1¾	16	7⅞	5	4¾	17	5⅜	5	7¾	18	2¾	5	10¾	19	0¼
4	10⅞	15	10⅞	5	1⅞	16	8⅜	5	4⅞	17	5¾	5	7⅞	18	3⅛	5	10⅞	19	0⅝
4	11	15	11¼	5	2	16	8¾	5	5	17	6⅛	5	8	18	3⅝	5	11	19	1
4	11⅛	15	11⅝	5	2⅛	16	9⅛	5	5⅛	17	6⅝	5	8⅛	18	4	5	11⅛	19	1⅜
4	11¼	16	0⅛	5	2¼	16	9½	5	5¼	17	7	5	8¼	18	4⅜	5	11¼	19	1¾
4	11⅜	16	0½	5	2⅜	16	9⅞	5	5⅜	17	7⅜	5	8⅜	18	4¾	5	11⅜	19	2⅛
4	11½	16	0⅞	5	2½	16	10¼	5	5½	17	7¾	5	8½	18	5⅛	5	11½	19	2½
4	11⅝	16	1¼	5	2⅝	16	10⅝	5	5⅝	17	8⅛	5	8⅝	18	5½	5	11⅝	19	3
4	11¾	16	1⅝	5	2¾	16	11⅛	5	5¾	17	8½	5	8¾	18	5⅞	5	11¾	19	3⅜
4	11⅞	16	2	5	2⅞	16	11½	5	5⅞	17	8⅞	5	8⅞	18	6⅜	5	11⅞	19	3¾

LENGTH OF BAR REQUIRED FOR 3 IN. ANGLE-IRON RINGS, EXTERNAL—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
6 0	19 4⅛	6 3	20 1½	6 6	20 11	6 9	21 8⅜	7 0	22 5⅞
6 0⅛	19 4½	6 3⅛	20 2	6 6⅛	20 11⅜	6 9⅛	21 8⅞	7 0⅛	22 6¼
6 0¼	19 4⅞	6 3¼	20 2⅜	6 6¼	20 11¾	6 9¼	21 9¼	7 0¼	22 6⅝
6 0⅜	19 5¼	6 3⅜	20 2¾	6 6⅜	21 0⅛	6 9⅜	21 9⅝	7 0⅜	22 7
6 0½	19 5¾	6 3½	20 3⅛	6 6½	21 0½	6 9½	21 10	7 0½	22 7⅜
6 0⅝	19 6⅛	6 3⅝	20 3½	6 6⅝	21 1	6 9⅝	21 10⅜	7 0⅝	22 7⅞
6 0¾	19 6½	6 3¾	20 3⅞	6 6¾	21 1⅜	6 9¾	21 10¾	7 0¾	22 8¼
6 0⅞	19 6⅞	6 3⅞	20 4¼	6 6⅞	21 1¾	6 9⅞	21 11⅛	7 0⅞	22 8⅝
6 1	19 7¼	6 4	20 4¾	6 7	21 2⅛	6 10	21 11½	7 1	22 9
6 1⅛	19 7⅝	6 4⅛	20 5⅛	6 7⅛	21 2½	6 10⅛	22 0	7 1⅛	22 9⅜
6 1¼	19 8	6 4¼	20 5½	6 7¼	21 2⅞	6 10¼	22 0⅜	7 1¼	22 9¾
6 1⅜	19 8½	6 4⅜	20 5⅞	6 7⅜	21 3¼	6 10⅜	22 0¾	7 1⅜	22 10⅛
6 1½	19 8⅞	6 4½	20 6¼	6 7½	21 3¾	6 10½	22 1⅛	7 1½	22 10½
6 1⅝	19 9¼	6 4⅝	20 6⅝	6 7⅝	21 4⅛	6 10⅝	22 1½	7 1⅝	22 11
6 1¾	19 9⅝	6 4¾	20 7	6 7¾	21 4½	6 10¾	22 1⅞	7 1¾	22 11⅜
6 1⅞	19 10	6 4⅞	20 7½	6 7⅞	21 4⅞	6 10⅞	22 2¼	7 1⅞	22 11¾
6 2	19 10⅜	6 5	20 7⅞	6 8	21 5¼	6 11	22 2¾	7 2	23 0⅛
6 2⅛	19 10¾	6 5⅛	20 8¼	6 8⅛	21 5⅝	6 11⅛	22 3⅛	7 2⅛	23 0½
6 2¼	19 11¼	6 5¼	20 8⅝	6 8¼	21 6	6 11¼	22 3½	7 2¼	23 0⅞
6 2⅜	19 11⅝	6 5⅜	20 9	6 8⅜	21 6½	6 11⅜	22 3⅞	7 2⅜	23 1¼
6 2½	20 0	6 5½	20 9⅜	6 8½	21 6⅞	6 11½	22 4¼	7 2½	23 1⅝
6 2⅝	20 0⅜	6 5⅝	20 9¾	6 8⅝	21 7¼	6 11⅝	22 4⅝	7 2⅝	23 2⅛
6 2¾	20 0¾	6 5¾	20 10¼	6 8¾	21 7⅝	6 11¾	22 5	7 2¾	23 2½
6 2⅞	20 1⅛	6 5⅞	20 10⅝	6 8⅞	21 8	6 11⅞	22 5½	7 2⅞	23 2⅞

LENGTH OF BAR REQUIRED FOR 3 IN. ANGLE-IRON RINGS, EXTERNAL—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	3	23	3¼	7	6	24	0⅝	7	9	24	10⅛	8	0	25	7½
7	3⅛	23	3⅝	7	6⅛	24	1⅛	7	9⅛	24	10½	8	0⅛	25	7⅞
7	3¼	23	4	7	6¼	24	1½	7	9¼	24	10⅞	8	0¼	25	8⅜
7	3⅜	23	4⅜	7	6⅜	24	1⅞	7	9⅜	24	11¼	8	0⅜	25	8¾
7	3½	23	4⅞	7	6½	24	2¼	7	9½	24	11⅝	8	0½	25	9⅛
7	3⅝	23	5¼	7	6⅝	24	2⅝	7	9⅝	25	0⅛	8	0⅝	25	9½
7	3¾	23	5⅝	7	6¾	24	3	7	9¾	25	0½	8	0¾	25	9⅞
7	3⅞	23	6	7	6⅞	24	3⅜	7	9⅞	25	0⅞	8	0⅞	25	10¼
7	4	23	6⅜	7	7	24	3⅞	7	10	25	1¼	8	1	25	10⅝
7	4⅛	23	6¾	7	7⅛	24	4¼	7	10⅛	25	1⅝	8	1⅛	25	11⅛
7	4¼	23	7⅛	7	7¼	24	4⅝	7	10¼	25	2	8	1¼	25	11½
7	4⅜	23	7⅝	7	7⅜	24	5	7	10⅜	25	2⅜	8	1⅜	25	11⅞
7	4½	23	8	7	7½	24	5⅜	7	10½	25	2⅞	8	1½	26	0¼
7	4⅝	23	8⅜	7	7⅝	24	5¾	7	10⅝	25	3¼	8	1⅝	26	0⅝
7	4¾	23	8¾	7	7¾	24	6⅛	7	10¾	25	3⅝	8	1¾	26	1
7	4⅞	23	9⅛	7	7⅞	24	6⅝	7	10⅞	25	4	8	1⅞	26	1⅜
7	5	23	9½	7	8	24	7	7	11	25	4⅜	8	2	26	1⅞
7	5⅛	23	9⅞	7	8⅛	24	7⅜	7	11⅛	25	4¾	8	2⅛	26	2¼
7	5¼	23	10⅜	7	8¼	24	7¾	7	11¼	25	5⅛	8	2¼	26	2⅝
7	5⅜	23	10¾	7	8⅜	24	8⅛	7	11⅜	25	5½	8	2⅜	26	3
7	5½	23	11⅛	7	8½	24	8½	7	11½	25	6	8	2½	26	3⅜
7	5⅝	23	11½	7	8⅝	24	8⅞	7	11⅝	25	6⅜	8	2⅝	26	3¾
7	5¾	23	11⅞	7	8¾	24	9⅜	7	11¾	25	6¾	8	2¾	26	4⅛
7	5⅞	24	0¼	7	8⅞	24	9¾	7	11⅞	25	7⅛				

Length of Bar required for 3 in. Angle-Iron Rings. Internal.

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
1 0	2 7⅝	1 3	3 5	1 6	4 2½	1 9	4 11⅞	2 0	5 9⅜
1 0⅛	2 8	1 3⅛	3 5½	1 6⅛	4 2⅞	1 9⅛	5 0⅜	2 0⅛	5 9¾
1 0¼	2 8⅜	1 3¼	3 5⅞	1 6¼	4 3¼	1 9¼	5 0¾	2 0¼	5 10⅛
1 0⅜	2 8⅞	1 3⅜	3 6¼	1 6⅜	4 3⅝	1 9⅜	5 1⅛	2 0⅜	5 10½
1 0½	2 9¼	1 3½	3 6⅝	1 6½	4 4	1 9½	5 1½	2 0½	5 10⅞
1 0⅝	2 9⅝	1 3⅝	3 7	1 6⅝	4 4⅜	1 9⅝	5 2	2 0⅝	5 11¼
1 0¾	2 10	1 3¾	3 7⅜	1 6¾	4 4⅞	1 9¾	5 2⅜	2 0¾	5 11¾
1 0⅞	2 10⅜	1 3⅞	3 7⅞	1 6⅞	4 5¼	1 9⅞	5 2¾	2 0⅞	6 0⅛
1 1	2 10¾	1 4	3 8¼	1 7	4 5⅝	1 10	5 3⅛	2 1	6 0½
1 1⅛	2 11⅛	1 4⅛	3 8⅝	1 7⅛	4 6	1 10⅛	5 3½	2 1⅛	6 0⅞
1 1¼	2 11⅝	1 4¼	3 9	1 7¼	4 6⅜	1 10¼	5 3⅞	2 1¼	6 1¼
1 1⅜	3 0	1 4⅜	3 9⅜	1 7⅜	4 6⅞	1 10⅜	5 4¼	2 1⅜	6 1⅝
1 1½	3 0⅜	1 4½	3 9¾	1 7½	4 7¼	1 10½	5 4⅝	2 1½	6 2
1 1⅝	3 0¾	1 4⅝	3 10⅛	1 7⅝	4 7⅝	1 10⅝	5 5	2 1⅝	6 2½
1 1¾	3 1⅛	1 4¾	3 10½	1 7¾	4 8	1 10¾	5 5⅜	2 1¾	6 2⅞
1 1⅞	3 1½	1 4⅞	3 11	1 7⅞	4 8⅜	1 10⅞	5 5¾	2 1⅞	6 3¼
1 2	3 1⅞	1 5	3 11⅜	1 8	4 8¾	1 11	5 6¼	2 2	6 3⅝
1 2⅛	3 2⅜	1 5⅛	3 11¾	1 8⅛	4 9⅛	1 11⅛	5 6⅝	2 2⅛	6 4
1 2¼	3 2¾	1 5¼	4 0⅛	1 8¼	4 9⅝	1 11¼	5 7	2 2¼	6 4⅜
1 2⅜	3 3⅛	1 5⅜	4 0½	1 8⅜	4 10	1 11⅜	5 7⅜	2 2⅜	6 4¾
1 2½	3 3½	1 5½	4 0⅞	1 8½	4 10⅜	1 11½	5 7¾	2 2½	6 5¼
1 2⅝	3 3⅞	1 5⅝	4 1⅜	1 8⅝	4 10¾	1 11⅝	5 8⅛	2 2⅝	6 5⅝
1 2¾	3 4¼	1 5¾	4 1¾	1 8¾	4 11⅛	1 11¾	5 8½	2 2¾	6 6
1 2⅞	3 4⅝	1 5⅞	4 2⅛	1 8⅞	4 11½	1 11⅞	5 9	2 2⅞	6 6⅜

LENGTH OF BAR REQUIRED FOR 3 IN. ANGLE-IRON RINGS, INTERNAL—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
2 3	6 6¾	2 6	7 4⅛	2 9	8 1⅝	3 0	8 11	3 3	9 8½
2 3⅛	6 7⅛	2 6⅛	7 4⅝	2 9⅛	8 2	3 0⅛	8 11⅜	3 3⅛	9 8⅞
2 3¼	6 7½	2 6¼	7 5	2 9¼	8 2⅜	3 0¼	8 11⅞	3 3¼	9 9⅛
2 3⅜	6 8	2 6⅜	7 5⅜	2 9⅜	8 2¾	3 0⅜	9 0¼	3 3⅜	9 9⅝
2 3½	6 8⅜	2 6½	7 5¾	2 9½	8 3¼	3 0½	9 0⅝	3 3½	9 10
2 3⅝	6 8¾	2 6⅝	7 6⅛	2 9⅝	8 3⅝	3 0⅝	9 1	3 3⅝	9 10½
2 3¾	6 9⅛	2 6¾	7 6½	2 9¾	8 4	3 0¾	9 1⅜	3 3¾	9 10⅞
2 3⅞	6 9½	2 6⅞	7 6⅞	2 9⅞	8 4⅜	3 0⅞	9 1¾	3 3⅞	9 11¼
2 4	6 9⅞	2 7	7 7⅜	2 10	8 4¾	3 1	9 2⅛	3 4	9 11⅝
2 4⅛	6 10¼	2 7⅛	7 7¾	2 10⅛	8 5⅛	3 1⅛	9 2⅝	3 4⅛	10 0
2 4¼	6 10¾	2 7¼	7 8⅛	2 10¼	8 5½	3 1¼	9 3	3 4¼	10 0⅜
2 4⅜	6 11⅛	2 7⅜	7 8½	2 10⅜	8 5⅞	3 1⅜	9 3⅜	3 4⅜	10 0¾
2 4½	6 11½	2 7½	7 8⅞	2 10½	8 6⅜	3 1½	9 3¾	3 4½	10 1⅛
2 4⅝	6 11⅞	2 7⅝	7 9¼	2 10⅝	8 6¾	3 1⅝	9 4⅛	3 4⅝	10 1⅝
2 4¾	7 0¼	2 7¾	7 9¾	2 10¾	8 7⅛	3 1¾	9 4½	3 4¾	10 2
2 4⅞	7 0⅝	2 7⅞	7 10⅛	2 10⅞	8 7½	3 1⅞	9 4⅞	3 4⅞	10 2⅜
2 5	7 1	2 8	7 10½	2 11	8 7⅞	3 2	9 5⅜	3 5	10 2¾
2 5⅛	7 1½	2 8⅛	7 10⅞	2 11⅛	8 8¼	3 2⅛	9 5¾	3 5⅛	10 3⅛
2 5¼	7 1⅞	2 8¼	7 11¼	2 11¼	8 8⅝	3 2¼	9 6⅛	3 5¼	10 3½
2 5⅜	7 2¼	2 8⅜	7 11⅝	2 11⅜	8 9	3 2⅜	9 6½	3 5⅜	10 3⅞
2 5½	7 2⅝	2 8½	8 0	2 11½	8 9½	3 2½	9 6⅞	3 5½	10 4⅜
2 5⅝	7 3	2 8⅝	8 0½	2 11⅝	8 9⅞	3 2⅝	9 7¼	3 5⅝	10 4¾
2 5¾	7 3⅜	2 8¾	8 0⅞	2 11¾	8 10¼	3 2¾	9 7⅝	3 5¾	10 5⅛
2 5⅞	7 3¾	2 8⅞	8 1¼	2 11⅞	8 10⅝	3 2⅞	9 8⅛	3 5⅞	10 5½

LENGTH OF BAR REQUIRED FOR 3 IN. ANGLE-IRON RINGS, INTERNAL—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
3 6	10 5⅞	3 9	11 3¼	4 0	12 0¾	4 3	12 10⅛	4 6	13 7⅜
3 6⅛	10 6¼	3 9⅛	11 3¾	4 0⅛	12 1⅛	4 3⅛	12 10½	4 6⅛	13 8
3 6¼	10 6⅝	3 9¼	11 4⅛	4 0¼	12 1½	4 3¼	12 11	4 6¼	13 8⅜
3 6⅜	10 7⅛	3 9⅜	11 4½	4 0⅜	12 1⅞	4 3⅜	12 11⅜	4 6⅜	13 8¾
3 6½	10 7½	3 9½	11 4⅞	4 0½	12 2¼	4 3½	12 11¾	4 6½	13 9⅛
3 6⅝	10 7⅞	3 9⅝	11 5¼	4 0⅝	12 2¾	4 3⅝	13 0⅛	4 6⅝	13 9½
3 6¾	10 8¼	3 9¾	11 5⅝	4 0¾	12 3⅛	4 3¾	13 0½	4 6¾	13 9⅞
3 6⅞	10 8⅝	3 9⅞	11 6	4 0⅞	12 3½	4 3⅞	13 0⅞	4 6⅞	13 10⅜
3 7	10 9	3 10	11 6½	4 1	12 3⅞	4 4	13 1¼	4 7	13 10¾
3 7⅛	10 9⅜	3 10⅛	11 6⅞	4 1⅛	12 4¼	4 4⅛	13 1¾	4 7⅛	13 11⅛
3 7¼	10 9⅞	3 10¼	11 7¼	4 1¼	12 4⅝	4 4¼	13 2⅛	4 7¼	13 11½
3 7⅜	10 10¼	3 10⅜	11 7⅝	4 1⅜	12 5	4 4⅜	13 2½	4 7⅜	13 11⅞
3 7½	10 10⅝	3 10½	11 8	4 1½	12 5½	4 4½	13 2⅞	4 7½	14 0¼
3 7⅝	10 11	3 10⅝	11 8⅜	4 1⅝	12 5⅞	4 4⅝	13 3¼	4 7⅝	14 0⅝
3 7¾	10 11⅜	3 10¾	11 8¾	4 1¾	12 6¼	4 4¾	13 3⅝	4 7¾	14 1⅛
3 7⅞	10 11¾	3 10⅞	11 9¼	4 1⅞	12 6⅝	4 4⅞	13 4	4 7⅞	14 1½
3 8	11 0⅛	3 11	11 9⅝	4 2	12 7	4 5	13 4½	4 8	14 1⅞
3 8⅛	11 0½	3 11⅛	11 10	4 2⅛	12 7½	4 5⅛	13 4⅞	4 8⅛	14 2¼
3 8¼	11 1	3 11¼	11 10⅜	4 2¼	12 7⅞	4 5¼	13 5¼	4 8¼	14 2⅝
3 8⅜	11 1⅜	3 11⅜	11 10¾	4 2⅜	12 8¼	4 5⅜	13 5⅝	4 8⅜	14 3
3 8½	11 1¾	3 11½	11 11⅛	4 2½	12 8⅝	4 5½	13 6	4 8½	14 3½
3 8⅝	11 2⅛	3 11⅝	11 11½	4 2⅝	12 9	4 5⅝	13 6⅜	4 8⅝	14 3⅞
3 8¾	11 2½	3 11¾	12 0	4 2¾	12 9⅜	4 5¾	13 6⅞	4 8¾	14 4¼
3 8⅞	11 2⅞	3 11⅞	12 0⅜	4 2⅞	12 9¾	4 5⅞	13 7¼	4 8⅞	14 4⅝

LENGTH OF BAR REQUIRED FOR 3 IN. ANGLE-IRON RINGS, INTERNAL—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
4	9	14	5	5	0	15	2 3/8	5	3	15	11 7/8	5	6	16	9 1/4	5	9	17	6 3/4
4	9 1/8	14	5 3/8	5	0 1/8	15	2 7/8	5	3 1/8	16	0 1/4	5	6 1/8	16	9 5/8	5	9 1/8	17	7 1/8
4	9 1/4	14	5 3/4	5	0 1/4	15	3 1/4	5	3 1/4	16	0 5/8	5	6 1/4	16	10 1/8	5	9 1/4	17	7 1/2
4	9 3/8	14	6 1/8	5	0 3/8	15	3 5/8	5	3 3/8	16	1	5	6 3/8	16	10 1/2	5	9 3/8	17	7 7/8
4	9 1/2	14	6 3/8	5	0 1/2	15	4	5	3 1/2	16	1 3/8	5	6 1/2	16	10 7/8	5	9 1/2	17	8 1/4
4	9 5/8	14	7	5	0 5/8	15	4 3/8	5	3 5/8	16	1 7/8	5	6 5/8	16	11 1/4	5	9 5/8	17	8 5/8
4	9 3/4	14	7 3/8	5	0 3/4	15	4 3/4	5	3 3/4	16	2 1/4	5	6 3/4	16	11 5/8	5	9 3/4	17	9
4	9 7/8	14	7 3/4	5	0 7/8	15	5 1/8	5	3 7/8	16	2 5/8	5	6 7/8	17	0	5	9 7/8	17	9 1/2
4	10	14	8 1/8	5	1	15	5 5/8	5	4	16	3	5	7	17	0 3/8	5	10	17	9 7/8
4	10 1/8	14	8 1/2	5	1 1/8	15	6	5	4 1/8	16	3 3/8	5	7 1/8	17	0 7/8	5	10 1/8	17	10 1/4
4	10 1/4	14	8 7/8	5	1 1/4	15	6 3/8	5	4 1/4	16	3 3/4	5	7 1/4	17	1 1/4	5	10 1/4	17	10 5/8
4	10 3/8	14	9 3/8	5	1 3/8	15	6 3/4	5	4 3/8	16	4 1/8	5	7 3/8	17	1 5/8	5	10 3/8	17	11
4	10 1/2	14	9 3/4	5	1 1/2	15	7 1/8	5	4 1/2	16	4 5/8	5	7 1/2	17	2	5	10 1/2	17	11 3/8
4	10 5/8	14	10 1/8	5	1 5/8	15	7 1/2	5	4 5/8	16	5	5	7 5/8	17	2 3/8	5	10 5/8	17	11 7/8
4	10 3/4	14	10 1/2	5	1 3/4	15	7 7/8	5	4 3/4	16	5 3/8	5	7 3/4	17	2 3/4	5	10 3/4	18	0 1/4
4	10 7/8	14	10 7/8	5	1 7/8	15	8 3/8	5	4 7/8	16	5 3/4	5	7 7/8	17	3 1/8	5	10 7/8	18	0 5/8
4	11	14	11 1/4	5	2	15	8 3/4	5	5	16	6 1/8	5	8	17	3 5/8	5	11	18	1
4	11 1/8	14	11 5/8	5	2 1/8	15	9 1/8	5	5 1/8	16	6 3/8	5	8 1/8	17	4	5	11 1/8	18	1 3/8
4	11 1/4	15	0 1/8	5	2 1/4	15	9 1/2	5	5 1/4	16	7	5	8 1/4	17	4 3/8	5	11 1/4	18	1 3/4
4	11 3/8	15	0 1/2	5	2 3/8	15	9 7/8	5	5 3/8	16	7 3/8	5	8 3/8	17	4 3/4	5	11 3/8	18	2 1/8
4	11 1/2	15	0 7/8	5	2 1/2	15	10 1/4	5	5 1/2	16	7 3/4	5	8 1/2	17	5 1/8	5	11 1/2	18	2 1/2
4	11 5/8	15	1 1/4	5	2 5/8	15	10 5/8	5	5 5/8	16	8 1/8	5	8 5/8	17	5 1/2	5	11 5/8	18	3
4	11 3/4	15	1 3/8	5	2 3/4	15	11 1/8	5	5 3/4	16	8 1/2	5	8 3/4	17	5 7/8	5	11 3/4	18	3 3/8
4	11 7/8	15	2	5	2 7/8	15	11 1/2	5	5 7/8	16	8 7/8	5	8 7/8	17	6 3/8	5	11 7/8	18	3 3/4

Length of Bar required for 3 in. Angle-Iron Rings, Internal—*continued.*

Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.	Diam.	Circum.
ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
6 0	18 4⅛	6 3	19 1½	6 6	19 11	6 9	20 8⅜	7 0	21 5⅞
6 0⅛	18 4½	6 3⅛	19 2	6 6⅛	19 11⅜	6 9⅛	20 8⅞	7 0⅛	21 6¼
6 0¼	18 4⅞	6 3¼	19 2⅜	6 6¼	19 11¾	6 9¼	20 9¼	7 0¼	21 6⅝
6 0⅜	18 5¼	6 3⅜	19 2¾	6 6⅜	20 0⅛	6 9⅜	20 9⅝	7 0⅜	21 7
6 0½	18 5¾	6 3½	19 3⅛	6 6½	20 0½	6 9½	20 10	7 0½	21 7⅜
6 0⅝	18 6⅛	6 3⅝	19 3½	6 6⅝	20 1	6 9⅝	20 10⅜	7 0⅝	21 7⅞
6 0¾	18 6½	6 3¾	19 3⅞	6 6¾	20 1⅜	6 9¾	20 10¾	7 0¾	21 8¼
6 0⅞	18 6⅞	6 3⅞	19 4¼	6 6⅞	20 1¾	6 9⅞	20 11⅛	7 0⅞	21 8⅝
6 1	18 7¼	6 4	19 4¾	6 7	20 2⅛	6 10	20 11½	7 1	21 9
6 1⅛	18 7⅝	6 4⅛	19 5⅛	6 7⅛	20 2½	6 10⅛	21 0	7 1⅛	21 9⅜
6 1¼	18 8	6 4¼	19 5½	6 7¼	20 2⅞	6 10¼	21 0⅜	7 1¼	21 9¾
6 1⅜	18 8½	6 4⅜	19 5⅞	6 7⅜	20 3¼	6 10⅜	21 0¾	7 1⅜	21 10⅛
6 1½	18 8⅞	6 4½	19 6¼	6 7½	20 3¾	6 10½	21 1⅛	7 1½	21 10½
6 1⅝	18 9¼	6 4⅝	19 6⅝	6 7⅝	20 4⅛	6 10⅝	21 1½	7 1⅝	21 11
6 1¾	18 9⅝	6 4¾	19 7	6 7¾	20 4½	6 10¾	21 1⅞	7 1¾	21 11⅜
6 1⅞	18 10	6 4⅞	19 7½	6 7⅞	20 4⅞	6 10⅞	21 2¼	7 1⅞	21 11¾
6 2	18 10⅜	6 5	19 7⅞	6 8	20 5¼	6 11	21 2¾	7 2	22 0⅛
6 2⅛	18 10¾	6 5⅛	19 8¼	6 8⅛	20 5⅝	6 11⅛	21 3⅛	7 2⅛	22 0½
6 2¼	18 11¼	6 5¼	19 8⅝	6 8¼	20 6	6 11¼	21 3½	7 2¼	22 0⅞
6 2⅜	18 11⅝	6 5⅜	19 9	6 8⅜	20 6½	6 11⅜	21 3⅞	7 2⅜	22 1¼
6 2½	19 0	6 5½	19 9⅜	6 8½	20 6⅞	6 11½	21 4¼	7 2½	22 1⅝
6 2⅝	19 0⅜	6 5⅝	19 9¾	6 8⅝	20 7¼	6 11⅝	21 4⅝	7 2⅝	22 2⅛
6 2¾	19 0¾	6 5¾	19 10¼	6 8¾	20 7⅝	6 11¾	21 5	7 2¾	22 2½
6 2⅞	19 1⅛	6 5⅞	19 10⅝	6 8⅞	20 8	6 11⅞	21 5½	7 2⅞	22 2⅞

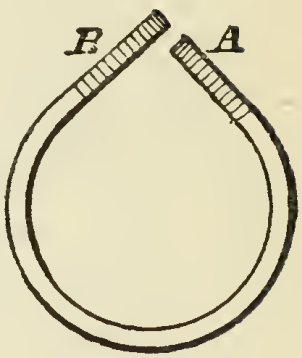
Length of Bar required for 3 in. Angle-Iron Rings, Internal—*continued.*

Diam.		Circum.		Diam.		Circum.		Diam.		Circum.		Diam.		Circum.	
ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.	ft.	in.
7	3	22	3¼	7	6	23	0⅝	7	9	23	10⅛	8	0	24	7½
7	3⅛	22	3⅝	7	6⅛	23	1⅛	7	9⅛	23	10½	8	0⅛	24	7⅞
7	3¼	22	4	7	6¼	23	1½	7	9¼	23	10⅞	8	0¼	24	8⅝
7	3⅜	22	4⅜	7	6⅜	23	1⅞	7	9⅜	23	11¼	8	0⅜	24	8¾
7	3½	22	4⅞	7	6½	23	2¼	7	9½	23	11⅝	8	0½	24	9⅛
7	3⅝	22	5¼	7	6⅝	23	2⅝	7	9⅝	24	0⅛	8	0⅝	24	9½
7	3¾	22	5⅝	7	6¾	23	3	7	9¾	24	0½	8	0¾	24	9⅞
7	3⅞	22	6	7	6⅞	23	3⅜	7	9⅞	24	0⅞	8	0⅞	24	10¼
7	4	22	6⅜	7	7	23	3⅞	7	10	24	1¼	8	1	24	10⅝
7	4⅛	22	6¾	7	7⅛	23	4¼	7	10⅛	24	1⅝	8	1⅛	24	11⅛
7	4¼	22	7⅛	7	7¼	23	4⅝	7	10¼	24	2	8	1¼	24	11½
7	4⅜	22	7⅝	7	7⅜	23	5	7	10⅜	24	2⅜	8	1⅜	24	11⅞
7	4½	22	8	7	7½	23	5⅜	7	10½	24	2⅞	8	1½	25	0¼
7	4⅝	22	8⅜	7	7⅝	23	5¾	7	10⅝	24	3¼	8	1⅝	25	0⅝
7	4¾	22	8¾	7	7¾	23	6⅛	7	10¾	24	3⅝	8	1¾	25	1
7	4⅞	22	9⅛	7	7⅞	23	6⅝	7	10⅞	24	4	8	1⅞	25	1⅜
7	5	22	9½	7	8	23	7	7	11	24	4⅜	8	2	25	1⅞
7	5⅛	22	9⅞	7	8⅛	23	7⅜	7	11⅛	24	4¾	8	2⅛	25	2¼
7	5¼	22	10⅜	7	8¼	23	7¾	7	11¼	24	5⅛	8	2¼	25	2⅝
7	5⅜	22	10¾	7	8⅜	23	8⅛	7	11⅜	24	5½	8	2⅜	25	3
7	5½	22	11⅛	7	8½	23	8½	7	11½	24	6	8	2½	25	3⅜
7	5⅝	22	11½	7	8⅝	23	8⅞	7	11⅝	24	6⅜	8	2⅝	25	3¾
7	5¾	22	11⅞	7	8¾	23	9⅜	7	11¾	24	6¾	8	2¾	25	4⅛
7	5⅞	23	0¼	7	8⅞	23	9¾	7	11⅞	24	7⅛	8	2⅞	25	4½

Welding in General.

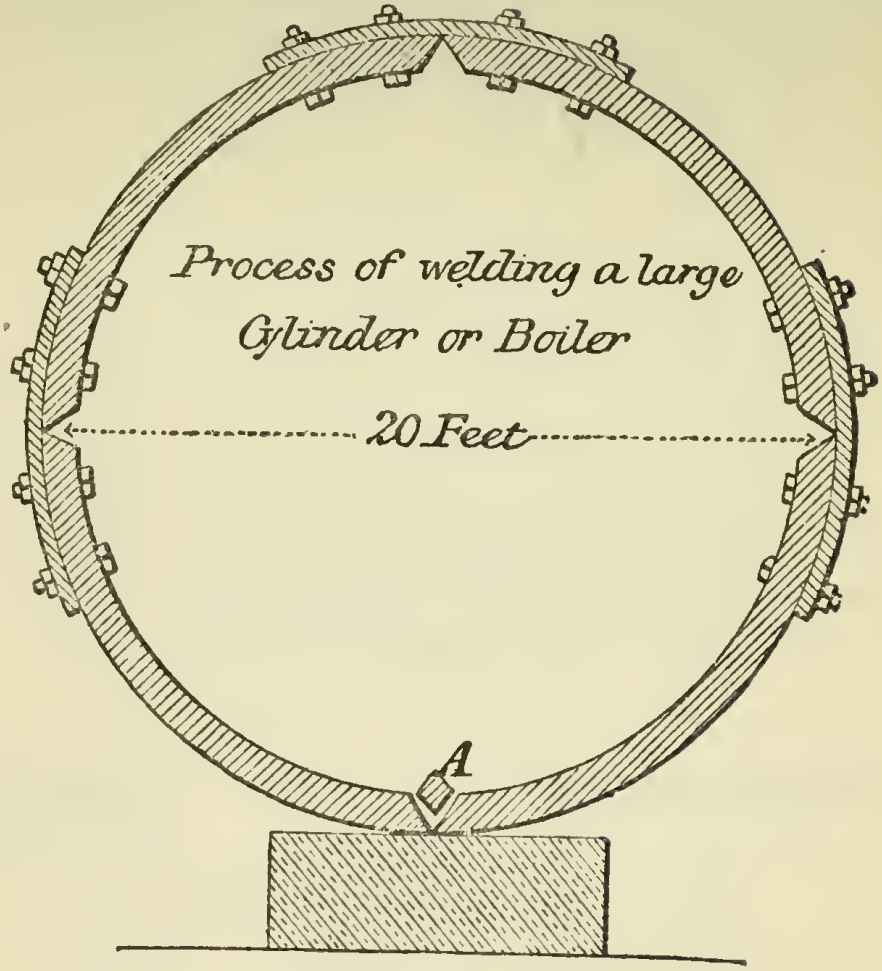
The three principal things to be observed in welding are:—First, properly prepare the parts to be welded; second, make them properly hot; and third, strike them in the right place, and not too hard the first few blows. Pipes or cylinders up to four feet diameter may be easily welded (but when you come to the larger diameters, say two feet six and upwards, it will be necessary to dig a hole in the ground under the mandril) in the following manner:—Bend the pipe or cylinder in the form of Fig. 14; do not let the edges A B touch each other by about a quarter of an inch; then place it on a clear fire, throw a little sand and scale on the edges, which should be downwards of course, place a fire-brick on the part through which the greatest heat is coming. The brick is a very slow conductor of heat, and will greatly assist the iron in getting hot, as it does not absorb much heat itself. Put the blast on slowly until the iron becomes of a pale yellow colour; then put the blast full on until it changes to a bright white, like the sun at midday; then bring it out and place it on the mandril as quickly as possible. Let the first blow fall gently on the edge, A, and hammer B down on it. When you find that the iron is not too hot so as to fly to pieces under the blow, strike as hard and quick as you can until the edge has disappeared and a

Fig. 14.



smooth surface is left. This method of welding pipes is sounder than any other. Some persons have an arrangement of a forge on wheels made to run inside the cylinder, with an india-rubber blast-pipe connected to it, and when the lap of the plate is sufficiently heated, the forge is withdrawn and an anvil wheeled in its place; but the former method is preferable for many reasons. Boilers up to 20 ft. diameter may be soundly welded at the longitudinal seams as follows. But I do not recommend (very strongly) welded boilers which are intended to be worked at very great pressures, although if done by careful and experienced workmen they are, beyond doubt, much stronger than when nearly a third of the iron is punched away in rivet-holes. In welding a large boiler, say 20 ft diameter, 1 in. thick, with four plates to the circle, first punch the plates along each side, leaving about a foot unpunched at each end; next plane each end to an angle of forty-five degrees with the surface of the plate; then roll and set them, and fasten them together, the planed part to be inside They can be easily fastened by means of a piece of plate bolted across the openings. Heat the edges upon a clear fire, as before described; at the same time heat a piece of square iron in a separate fire, and, when sufficiently heated, bring out the boiler, which must, of course, be suspended from a good crane, the shop-traveller—say, if there is one—and place it on the block or slab; then lay in the piece of square iron corner-wise, as shown in the following sketch, and hammer direct on the top corner.

Fig. 15.



Remarks.

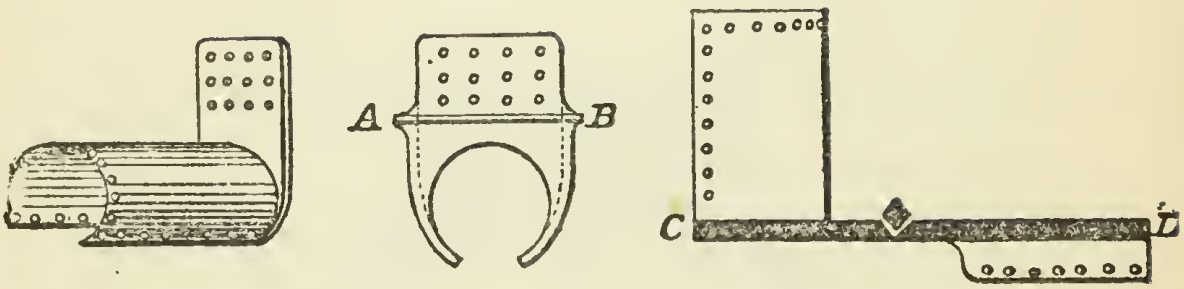
The piece of square iron, A, should be a little hotter than the plates.

Six or seven inches at a heat will be sufficient to weld. Do not allow the weight of the circle of plates to rest on the block, or it will become flat. For the size of the bar, have its sides equal in width to the planed edge of the plate. If there is no planing-machine, cut the corner of the plate off with a hot-set; keep the two plates securely bolted

at the sides, and commence welding in the middle. In putting the separate rings of the boiler together, do not place the welded parts opposite each other; and in the case of welded furnace-tubes, always keep the welded part well below the firegrate.

To weld the back tube-plate to the top of the furnace of a marine boiler, as in Fig. 16, first

Fig. 16. Fig. 17. Fig. 18.



punch, roll, and flange the furnace-top as shown in the lower part of Fig. 17; and flange and bore the tube-plate, leaving a portion unflanged, as in the upper half of Fig. 17. If the tube-plate is of thicker iron than the furnace-plate, as it certainly should be, thicken the edge of the furnace-plate from A to B equal to the tube-plate; then bevel the edges to be welded as explained on page 92, fasten the plates together at the outer edges, which can be easily done, say by a strip and two clamps or boiler-screws at each side; hang up the whole as shown in Fig. 18, and weld in a square bar, commencing in the centre. When the welding is completed, flange down the remaining portion of the sides, as shown by the dotted lines in Fig. 17. The edge of the plate C D, in Fig. 18, is shown disproportionately thick for illustration-

sake. In making the fronts of marine boilers, which is often desirable to have all in one piece, it is very often difficult to get a plate sufficiently

Fig. 19.

Fig. 20.

Elevation of Plain Front of Marine Boiler Screwed together for Welding in Two Plates.

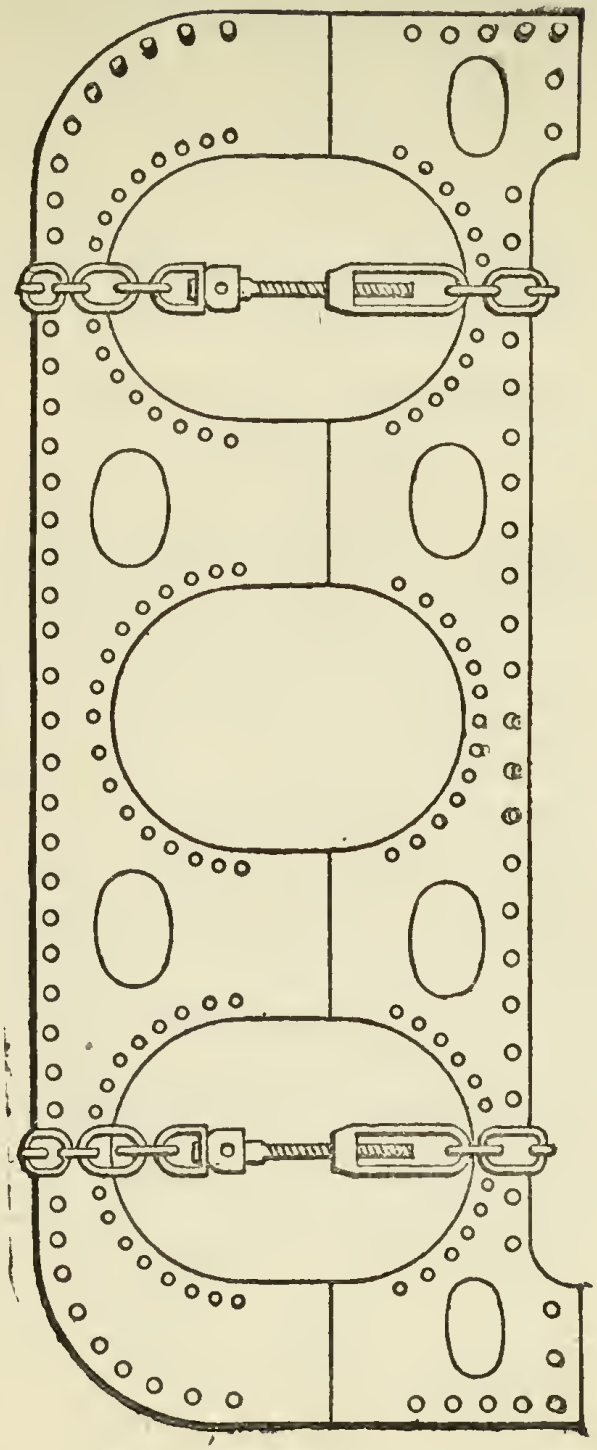


Fig. 21.

large for the purpose, in which case two plates must either be welded or lapped together; and as a seam of rivets across the front of a boiler is always objectionable, they should be welded, either by laying in the square bar, or as follows:—first cut out the holes for the furnaces and flange them, if they are to be flanged, leaving a portion unflanged where the weld is to take place; then thicken both edges, and split one and taper the other, as shown in Fig. 19, which is a section or edge-view. When this is done, force one into the other, and close them over, as in Fig. 20; then secure the two plates by two or three pieces of angle-iron bolted to them, also two stretching-screws, Fig. 21, and then place in the fire. When the plate is hot, the expansion of the metal acting against the strain of the stretching-screws will weld the plates even before they are hammered on the block, which, of course, must be done when sufficiently heated.

Welding Angle-iron Rings.

First ascertain the length of bar wanted to make the rings of the size given; then upset each end and scarf or bevel them, one on the inside, the other on the outside of the angle, next take a short heat, and bend about 6 in. of each end; then take as long a heat as you can, and bend the ring round a segment or piece of iron bent to the required sweep. In closing the ends of an external ring before welding, do it so as to leave a lump inside, as in Fig. 22; because an external ring must be hammered on the inside during the

welding process: in the case of internal rings, leave the lump on the outside, as in Fig. 23; for that is the side on which they are hammered.

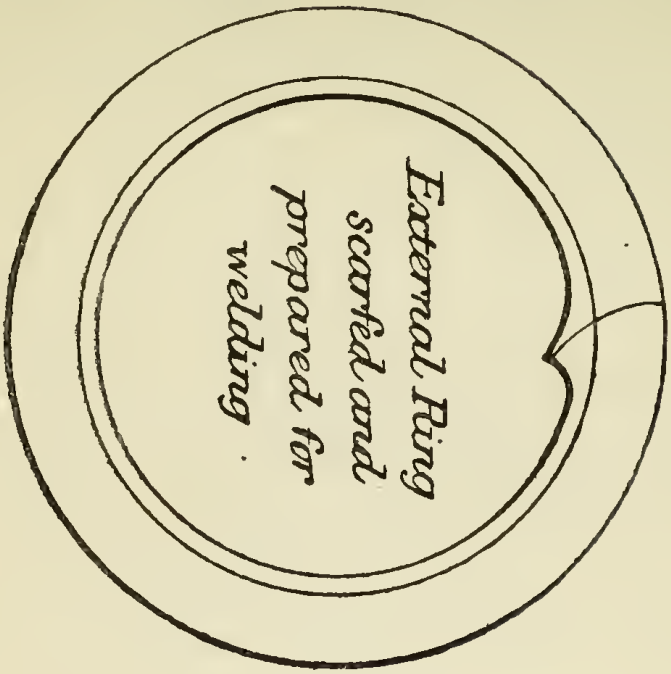


Fig. 22.

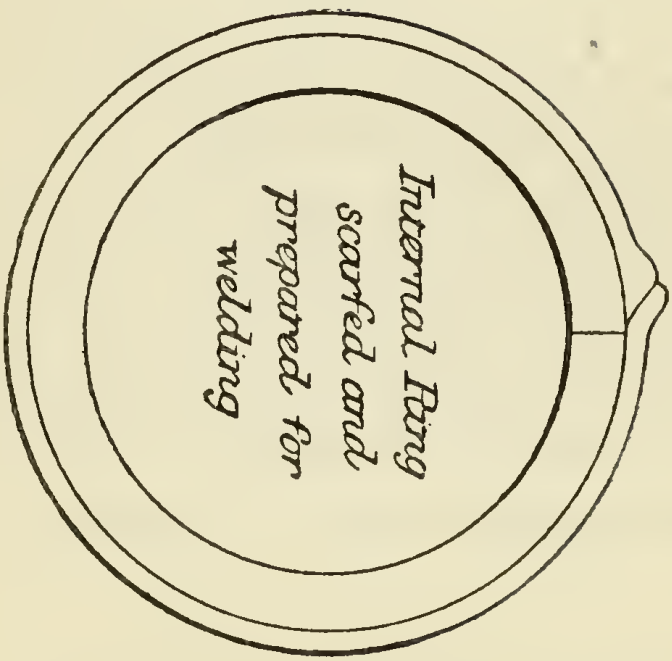


Fig. 23.

Always endeavour to have the welded part of an angle-ring, or, in fact, anything else, slightly

thicker than the other part of it when finished, which is easily done by observing the rules here given.

To make up a Fire for Welding.

When about to make up your fire for welding something, bear in mind that you do not want to make the article in question hot all over, but merely the part which is to be welded; therefore confine the size of your fire to the size of whatever you want to make hot. If an angle-iron ring, proceed thus:—Clean your forge out thoroughly of all that is not coal-dust; then wet what remains on the forge, and place a piece of wood, about 18 in. long by 4 in. square, close to the mouth of the tuyere (commonly called two-iron), wet and mix up your small coal to the consistency of mortar, and surround the piece of wood with it, well packing it down; and when sufficiently high, say 9 in. above the tuyere, draw the piece of wood carefully up, which will leave a hole 4 in square, and about 6 in. below the tuyere. Fill this hole with clean hot coke, and throw a little fresh coke, broken to the size of large walnuts, on it; next put on your angle-ring with the edges upwards, like the letter V, in its right position, having previously thrown on about a table-spoonful of sand and scale mixed; throw a handful of pieces of hard coke, broken very small, upon the sand and scale, and cover it with a fire-brick; put the blast gently on, and build up to the brick with a little wet coal, making the part of the angle-iron being heated, as it were, in a little furnace. Look

at your heat from time to time, and when it looks white, and the sand and scale is melted and swimming about, it is fit to bring out. If you find your fire becoming empty, throw in a handful of small hard coke from time to time. In welding anything whatever, keep the part being heated covered with a fire-brick, and a little bank of coal, built up to the ends of the brick if possible. Do not constantly poke and fidget the fire while the heat is getting hot; and do not put on too much blast at first, it will only blow the fire all away before the iron becomes heated. Finally, keep your wits about you, and have your tools in their proper places. Do not be looking for what you want while the heat is getting cold on the anvil. Some persons may think this advice superfluous, I only wish it was.

General Remarks on the Cornish or Single-flued Boiler.

Let the flue or tube be at least half the diameter of the shell; flange the front of the boiler on to the shell. Let the steam-chest be about the middle of the boiler. Do not punch the plate all away where the steam-chest is to go, except in very small steam-chests, say 18 in. diameter. Punch a round hole in the shell leading to the steam-chest twice the area of the steam valve. Let the steam-chest be flanged at top and bottom. Do not use angle-iron rings. Have the man-hole near the front of the boiler, and have it strengthened with an external ring equal to the amount of iron cut away in making the hole; have no

complications about the man-hole door. The two best descriptions are: first, the common door fitting inside the boiler, with two long $1\frac{1}{4}$-in. bolts, a handle, and two wrought-iron cross-bars outside. Always use square nuts, the corners wear off hexagon ones and make them difficult to fit the spanner. Second, the cast-iron door, faced and bolted to a faced ring with $\frac{3}{4}$-in. bolts and nuts, but avoid if possible all man-hole doors fitted on the outside of the boiler. In making the flue do not have any rivets in the fire. Let the first plate over the fire be longer than the firegrate, and keep the side-seams below the bars. Strengthen the flue with Galloway tubes, the first one as near the fire as possible, and the welded part towards the back of the boiler. Expansion rings should be used if the flue is a long one. Flues made of a succession of welded rings, and fastened together with external flanges, are strong and nice-looking, but not easy to repair. Do not have the laps of the plates looking towards the fire. Let the plate immediately over the fire always be of Lowmoor or Bowling iron—they are equal in quality to each other. Stay the ends of the shell with gusset-stays, but do not make them too rigid; this will be prevented if the bottom of the stay is kept eight inches away from the top of the flue.

General Remarks on Lancashire or Double-flued Boilers.

All that has been said of the Cornish boiler applies equally to the Lancashire boiler; and in

making very long boilers many people argue that the weight of the water and the pressure of steam inside have a strong tendency to press the flues down towards the bottom of the boiler. Very little reflection will show that this is entirely a mistake; and that the cradles and stays securing the tube to the bottom of the shell do a deal of harm and no good, because when the boiler is at work the tubes or flues are covered with water and filled with hot air, and have, therefore, a strong tendency to float, which they certainly would if not held down at the ends. This tendency is increased by the expansion of the top of the tube, as already explained; therefore every time the boiler is heated the tubes lift themselves off the cradles, which experience has shown every person who has tried it that they ought not to be fastened to both shell and tube. While they are thus off, a little sediment attaches itself to the bottom of the tubes and top of the cradles, and when the boiler cools the tubes cannot return to their old place, but remain strained upwards. This evil increases every time the boiler is made hot and cold, until at last some "unaccountable" leak occurs. I have seen seven-eighths of an inch of scale between the bottom of a tube and the cradle on which it was supposed to have lain close when new. If the cradles are riveted to both shell and tubes, there is a liability of the bottom of the boiler being destroyed through constant leakage of the rivets. Do not have any cradles for the tubes inside the boiler. If you can avoid it, never have a seam across the front of the boiler in the narrow space between the

tubes and the shell. If there must be a seam, keep it high up above the centre of the tubes, and do not in any case have a butt-joint there. Never screw the blow-off pipe into the bottom of the boiler, but rivet on a faced cast-iron seating, with recesses on the outside prepared to receive bolts without putting them through the boiler, and fasten all connections on the same way. Have no bolts put through the boiler. The furnace-front is best fastened on with studs screwed into the front of the boiler and securely caulked. Do not rivet the brackets for supporting the fire-bars to the furnace sides, but screw studs into the plate and caulk them, and fasten the brackets on with a nut on each stud. If they are riveted on, and they leak at any time, the only way to make them tight is to caulk the rivet-heads inside the boiler; but if the studs leak you can take off the nuts and caulk them without letting the water out of the boiler.

PROPORTIONS OF CYLINDRICAL BOILERS.

Horse-Power.	Length.		Diameter of Shell.		Number of Flues.	Diameter of Flues.	
	ft.	in.	ft.	in.		ft.	in.
One	6	0	1	9	..	..	
Two	7	6	2	0	..	..	
Three	9	0	2	6	..	..	
Four	10	0	2	9	..	..	
Five	11	0	3	0	..	..	
Ten	16	0	4	6	One .	2	3
Fifteen . . .	18	0	5	3	One .	2	8
Twenty. . .	20	0	6	0	Two .	2	4
Twenty-five .	25	0	6	0	Two .	2	4
Thirty . . .	23	0	6	6	Two .	2	6
Thirty-five. .	30	0	7	0	Two .	2	9
Forty	30	0	7	6	Two .	3	0

The best cylindrical boiler is that patented by Messrs. Hodge, of Millwall. It can be used either as a land or marine boiler. It requires no setting; and evaporates more water per pound of fuel than any other boiler.

PROPORTIONS OF HODGE'S PATENT BOILERS.

Horse-Power.	Length.		Diameter of Shell.		Number of Flues.	Diameter of Flues.	
	ft.	in.	ft.	in.		ft.	in.
Fifteen	7	0	5	6	One .	2	4
Twenty	7	6	6	0	One .	2	7
Twenty-five . . .	8	6	6	4½	One .	2	9
Thirty	9	6	6	6	One .	2	9
Forty	10	4	7	10	Two .	2	4
Fifty	12	0	8	4	Two .	2	7
Sixty	14	0	8	6	Two .	2	9
Seventy	14	0	9	3	Two .	2	9
Eighty	14	0	9	8	Two .	2	9¾

TO DETERMINE THE THICKNESS OF THE SHELL-PLATES OF CYLINDRICAL BOILERS.

Multiply the diameter in inches by the working pressure in pounds per square inch, and divide by 10,000; the result is the answer in inches or parts.

PROPORTIONS OF VERTICAL BOILERS WITH CROSS WATER-TUBES. THE GIVEN DIAMETER OF FIRE-BOX IS THE BOTTOM, THE TOP IN EACH CASE TO BE THREE INCHES LESS IN DIAMETER.

Horse-Power.	Height of Shell.		Diameter of Shell.		Diameter of Fire-box.		Number of Tubes.	Diameter of Tubes.
	ft.	in.	ft.	in.	ft.	in.		in.
One . . .	5	0	2	0	1	3	One .	8
Two . . .	5	2	2	3	1	6	One .	8
Three . .	5	6	2	6	1	9	One .	8
Four . . .	5	10	2	10	2	2	One .	8
Five . . .	6	2	3	0	2	6	One .	9
Six . . .	6	6	3	2	2	8	One .	10
Seven . .	6	10	3	4	2	10	One .	11
Eight. . .	7	6	3	6	3	0	Two .	11
Nine . . .	7	9	3	8	3	2	Two .	12
Ten . . .	8	2	3	10	3	4	Three	9
Eleven . .	8	7	4	0	3	6	Three	9½
Twelve . .	9	0	4	2	3	8	Three	10½
Thirteen .	9	3	4	4	3	10	Four .	9
Fourteen .	9	6	4	6	4	0	Four .	9½
Sixteen . .	9	9	4	8	4	2	Six .	8
Eighteen .	10	0	4	10	4	4	Six .	9
Twenty . .	10	3	5	0	4	6	Six .	9½
Twenty-five	10	6	5	2	4	8	Six .	10
Thirty . .	10	8	5	6	5	0	Six .	10½
Thirty-five .	10	10	5	8	5	2	Six .	11
Forty . .	11	0	5	10	5	4	Six .	12

Requisite Heating-Surface of Boilers.

Marine boilers, 18 to 20 square feet of heating-surface per horse-power.

Vertical boilers, 7 square feet ditto ditto.

Locomotive boilers, 12 to 13 square feet ditto ditto.

The number of cubic feet of water evaporated per hour indicates the number of horse-power of the boiler.

Thus a boiler that evaporates or "boils away" 40 cubic feet of water per hour is a 40-horse boiler.

Weight of a Square Foot of Sheet-Iron and Boiler Plate of every Ordinary Thickness.

in.		lbs.	
$\frac{1}{32}$	thick weighs	$1\frac{1}{4}$	per square foot.
$\frac{1}{16}$	,,	$2\frac{1}{2}$	,,
$\frac{3}{32}$	,,	$3\frac{3}{4}$	,,
$\frac{1}{8}$	,,	5	,,
$\frac{5}{32}$	,,	$6\frac{1}{4}$	,,
$\frac{3}{16}$	,,	$7\frac{1}{2}$	,,
$\frac{7}{32}$	,,	$8\frac{3}{4}$	,,
$\frac{1}{4}$	,,	10	,,
$\frac{9}{32}$	,,	$11\frac{1}{4}$	,,
$\frac{5}{16}$	,,	$12\frac{1}{2}$	,,
$\frac{11}{32}$	,,	$13\frac{3}{4}$	,,
$\frac{3}{8}$	,,	15	,,
$\frac{13}{32}$	,,	$16\frac{1}{4}$	,,
$\frac{7}{16}$	,,	$17\frac{1}{2}$	,,
$\frac{15}{32}$	,,	$18\frac{3}{4}$	,,
$\frac{1}{2}$	,,	20	,,

in.		lbs.	
$\frac{17}{32}$	thick weighs	$21\frac{1}{4}$	per square foot.
$\frac{9}{16}$	,,	$22\frac{1}{2}$	,,
$\frac{19}{32}$	,,	$23\frac{3}{4}$	,,
$\frac{5}{8}$	,,	25	,,
$\frac{21}{32}$	,,	$26\frac{1}{4}$	,,
$\frac{11}{16}$	,,	$27\frac{1}{2}$	,,
$\frac{23}{32}$	,,	$28\frac{3}{4}$	,,
$\frac{3}{4}$	,,	30	,,
$\frac{25}{32}$	,,	$31\frac{1}{4}$	,,
$\frac{13}{16}$	,,	$32\frac{1}{2}$	,,
$\frac{27}{32}$	,,	$33\frac{3}{4}$	,,
$\frac{7}{8}$	,,	35	,,
$\frac{29}{32}$	,,	$36\frac{1}{4}$	,,
$\frac{15}{16}$	,,	$37\frac{1}{2}$	,,
$\frac{31}{32}$	,,	$38\frac{3}{4}$	,,
1	,,	40	,,

Decimal Equivalents to the Divisions of an Inch.

	inch.		inch.
·96875. . . .	$\frac{31}{32}$	·46875 . . .	$\frac{15}{32}$
·9375	$\frac{15}{16}$	·4375 . . .	$\frac{7}{16}$
·90625. . . .	$\frac{29}{32}$	·40625 . . .	$\frac{13}{32}$
·875	$\frac{7}{8}$	·375 . . .	$\frac{3}{8}$
·84375. . . .	$\frac{27}{32}$	·34375 . . .	$\frac{11}{32}$
·8125	$\frac{13}{16}$	·3125 . . .	$\frac{5}{16}$
·78125. . . .	$\frac{25}{32}$	·28125 . . .	$\frac{9}{32}$
·75	$\frac{3}{4}$	·25 . . .	$\frac{1}{4}$
·71875. . . .	$\frac{23}{32}$	·21875 . . .	$\frac{7}{32}$
·6875	$\frac{11}{16}$	·1875 . . .	$\frac{3}{16}$
·65625. . . .	$\frac{21}{32}$	·15625 . . .	$\frac{5}{32}$
·625	$\frac{5}{8}$	·125 . . .	$\frac{1}{8}$
·59375. . . .	$\frac{19}{32}$	·09375 . . .	$\frac{3}{32}$
·5625	$\frac{9}{16}$	·0625 . . .	$\frac{1}{16}$
·53125. . . .	$\frac{17}{32}$	·03125 . . .	$\frac{1}{32}$
·5	$\frac{1}{2}$		

Expansion of Iron and Brass.

Iron, when made red-hot, expands about $\frac{3}{16}$ in. in a foot.

Brass, when made red-hot, expands about $\frac{3}{32}$ in. in a foot.

A pattern-maker's expansion rule should be made $\frac{3}{16}$ in. and $\frac{3}{32}$ in. in a foot long for patterns for iron and brass respectively.

Decimal Equivalents to the Divisions of a Foot.

	0	1 in.	2 in.	3 in.	4 in.	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.
..	..	·08333	·16666	·25	·33333	·41666	·5	·58333	·66666	·75	·83333	·91666
1/16	·00521	·08854	·17187	·25521	·33854	·42187	·50521	·58854	·67187	·75521	·83854	·92187
1/8	·01041	·09374	·17707	·26041	·34374	·42707	·51041	·59374	·67707	·76041	·84374	·92707
3/16	·01562	·09895	·18228	·26562	·34895	·43228	·51562	·59895	·68228	·76562	·84895	·93228
1/4	·02083	·10416	·18750	·27083	·35416	·43750	·52083	·60416	·68750	·77083	·85416	·93750
5/16	·02604	·10937	·19270	·27604	·35937	·44270	·52604	·60937	69270	·77604	·85937	·94270
3/8	·03125	·11458	·19791	·28125	·36458	·44791	·53125	·61458	·69791	·78125	·86458	·94791
7/16	·03646	·11979	·20312	·28646	·36979	·45312	·53646	·61979	·70312	·78646	·86979	·95312
1/2	·04166	·12500	20832	·29166	·37500	·45833	·54166	·62500	·70832	·79166	·87500	·95833
9/16	·04687	·13020	·21353	·29687	·38020	·46353	·54687	·63020	71353	·79687	·88020	·96353
5/8	·05208	·13541	·21874	·30208	·38541	·46875	·55208	·63541	·71874	·80208	·88541	·96875
11/16	·05729	·14062	·22395	·30729	·39062	·47395	·55729	·64062	·72395	·80729	·890 2	·97395
3/4	·06250	·14583	·22916	·31250	·39583	·47916	·56250	·64583	·72916	·81250	·89583	·97916
13/16	·06771	·15004	23437	·31771	·40004	·48437	·56771	·65004	·73437	·81771	·90004	·98437
7/8	·07292	·15625	·23958	·32292	·40625	·48958	·57292	·65625	·73958	·82292	·90625	·98958
15/16	·07813	·16146	·24479	·32813	·41146	·49479	·57813	·66146	·74479	·82813	·91146	·99479

This Table will be found very useful in making up the weights of plates. Example:—What is the weight of a plate 3 ft. 7½ in. × 2 ft. 5¼ in. × ½ in. Run your eye down the column headed 7 in. until it meets the figures in a line with ½ in., which you will find to be ·62500, then look down the column headed 5 in., until it meets the figures opposite ¼ in., which you will find to be ·43750, then multiply 3·62500 by 2·43750, and multiply the result by 20, that being the number of lbs. in a square foot of ½ in. plate. This will produce the figures 175·5187500000, being a very little over 1 cwt. 2 qrs. 7½ lbs.

Expansion rings of Lowmoor or Bowling iron are very beneficial in the construction of the tubes of Cornish or Lancashire boilers.

Marine Boilers.

Marine boilers may be divided into three classes, viz., the wet and dry bottom low-pressure, and the high-pressure boilers. Low-pressure boilers vary in shape to suit a variety of purposes; for instance, the shape of the part of the ship they are to fit, the manner in which they are to connect to each other when several boilers are to go in one vessel, &c. But generally they are made with an overhanging front, and the bottom of the back receding, and with the sides straight up and down. By carefully studying the rules for striking out steam-chests you will readily learn how to line out the curve of the development of the back and front. Stay all the flat surfaces with bars of 4 in. × 4 in. × $\frac{1}{2}$ in. tee-iron, never more than 18 in. apart from centre to centre; and stay these to each other above, below, and between the tubes with $1\frac{1}{2}$ in. square iron or $3 \times \frac{3}{4}$ in. flat, or iron of equal sectional area, always using square or flat in preference to round iron. The back and front of the boiler above the tubes may be stayed with gusset-plates, which will give more room for cleaning the boiler. Let the back of the boiler be stayed to the back of the combustion chamber with $1\frac{1}{4}$ in. stays, 10 in. apart, screwed into the boiler and riveted at both ends. Let the boiler be well supplied with man- and mud-holes, as cleanliness is a very great

object. There is no very great difficulty in cleaning vertically between the tubes, but it is very difficult to clean between them horizontally or crosswise, especially close to the tube-plates Many boilers have their back tube-plates very quickly destroyed through the impossibility of cleaning them. I would, therefore, very strongly recommend a mud-hole to be made in the sides of the boiler opposite each end of the tubes, 4½ in. wide, and extending from the space between the two bottom rows to the space between the two top rows, and strengthened all round with a band of 2½ in. by ½-in. flat iron, with the rivets countersunk inside the boiler. Let the doors of these cleaning-holes be fitted with 1 in. studs, about 6 in. apart, and wrought iron cross-bars; thus, if the door was 3 ft. long it would have five studs and cross bars. This method is perfectly safe for low-pressure boilers; it enables the men to clean very easily between the tubes and the whole of the tube-plate, and the person in charge can readily see when they are properly cleaned. Do not have flat tops or flat sides to the furnaces if you can possibly avoid it; and do not rivet angle-iron or the ends of stays to any place subject to the action of the fire, without having ferrules or distance-pieces at least 1 in long, to allow the water to circulate freely between. The water-bridge, if there is one, should always have one end higher than the other, to allow the generating steam to get away, otherwise the plate is liable to become over-heated, and collapse or seriously strain itself. Very wide boilers should be fitted with partitions or wash-plates, to prevent the water

from running too quickly to one side during the rolling of the ship. The tubes of wide boilers are very often sprung through the water flowing to one side and allowing the opposite side to become overheated. Always screw the back end of the stay-tubes into the back tube-plate, and do not put nuts on the back ends. Dudgeon's patent tube-expander is the best instrument yet invented for tightening tubes. The accumulation of salt makes itself known more quickly in the bottoms of dry-bottom boilers than in wet ones (although the dry-bottom boiler is in many respects preferable to the wet one), therefore care should be taken not to leave any impediment in the way of cleaning out the bottoms of the legs or pockets. It very often happens that careless or ill-informed makers place all the stays directly in the way of the mud-holes, which entirely prevents the man from getting his rake or cleaning-tools in with anything at all like ease; and it very often occurs that such boilers become full of salt nearly up to the level of the fire-grate, in which case the part full of salt, as a matter of course, does not get hot and expand with the other portion; whereas if it gets fairly up to the level of the fire, the furnace sides become too hot, and bulge and crack, &c. The following sketch shows the best method of securing the bottom of the vertical stays of dry-bottom boilers.

High-pressure marine boilers are generally made cylindrical, sometimes they are made elliptical; the vertical way being the long axis. This is by no means a safe principle, and should never be adopted. The high-pressure boiler should be

quite round, with round furnaces; it should be all double riveted on the outside and lap-jointed. Many persons like butt-joints with a clumsy external strip, on the plea that it has a "strong look." It does not strengthen a boiler; and butt-jointed plates are very difficult to put together unless there is a space left between the butts. One source of trouble in this class of boiler is a strong

Fig. 24.

The best system of stay for dry-bottom boiler.

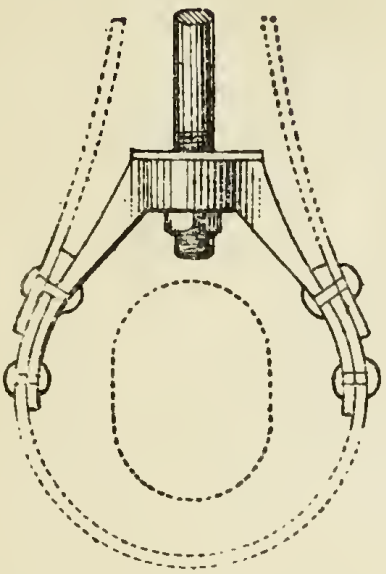
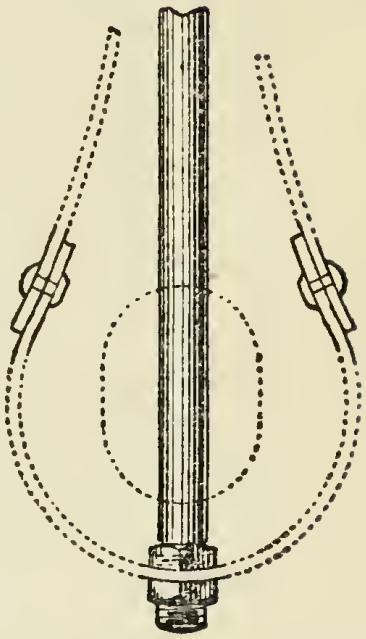


Fig. 25.

One of the most usual and worst methods of staying dry-bottom boilers.



disposition to strain itself in consequence of the top part becoming hotter and expanding more than the bottom. Water, it may be observed, is a very slow conductor of heat downwards; as you will readily see by filling an ordinary test-tube and holding it up in your hand with the middle over a spirit-lamp until it boils, which it will continue to do for a considerable time before

you feel any heat in your hand. It is, indeed, perfectly well known to persons at all practically acquainted with boilers, that the bottom of a boiler is frequently found to be cold while there is a certain pressure of steam indicated. To get over this disadvantage, it is desirable to keep the water in a continual state of circulation, and the most effective means of accomplishing this is to have a Galloway-tube, with the wide end upwards, in the combustion-chamber or back fire-box; and if the furnace of the boiler is long enough, put one Galloway-tube upright, or two in the form of the letter X, just beyond the bridge; this makes a perfect stay, and is the best medium of circulation. Do not have any seams of rivets in the furnace; and let all the plates exposed to the action of the fire be Lowmoor or Bowling iron. It will be found advantageous to have a 4-inch angle-iron ring round the furnace, with ferrules $1\frac{1}{4}$ in. long between it and the plate, and secured with thin-headed bolts (not rivets) screwed through the plate, which should be previously tapped, of course, and screwed up on the ring with nuts. The bolt-heads should be "laid up" and caulked lightly. Do not have an ordinary steam-chest flanged and riveted to the boiler, but one running along the top of the boiler, like a small cylindrical boiler, and secured with two small neck-pieces, the area of each to be twice the area of the steam-valve (see 'Areas of Circles,' page 123). If one end of the steam-chest projects through the top of the uptake it will help to keep the steam dry. Boilers fitted with this description of steam-chest are not so liable to prime as many others.

VERTICAL BOILERS.

The vertical cross-water tube-boiler is a very good form of steam-generator. The cross-tubes should be lower at the small end than at the other, to allow the steam to get away easily. And, for the same reason, the fire-box should be made slightly conical, the top being smallest, say about 1 in. in the foot; thus, if the fire-box is 3 ft. high, the top should be 3 in. less in diameter than the bottom, &c. Take care to have a mud-hole opposite the large end of each tube; and in placing the tubes in the fire-box, keep the welded part upwards away from the direct action of the fire. There is a matter of considerable importance in the construction of vertical boilers that is overlooked by many makers; it is this: there is generally a solid ring round the fire-hole connecting the fire-box to the shell; and in too many instances the fire-hole is placed so low down in the boiler that the fire itself lays continually against the edge of the hole; the result of this is that the lap of the inside plate which is riveted to the solid ring becomes very much hotter than the other part of the fire-box, which causes it to crack, bulge inwards, break the rivets, &c. If the ring is made of flanged plate or channel iron it will not be much, if at all, better, as it is very difficult to clean around such rings, especially the under side, and the sediment collecting amongst the rivet-heads makes it a solid ring eventually. The proper remedy is to keep the fire-hole as high as possible, say 18 in., from the level of the grate to the bottom of the fire-hole in a moderate-sized boiler.

General Remarks on Riveting.

There are four descriptions of riveting, viz., machine, snapped, counter-sunk, and hammered. The principal thing to bear in mind in boiler-riveting is to keep the lap close and the holes "fair;" and for good, sound work, machine riveting is the best; hammered rivets are more brittle and much more expensive than machine or snapped riveting. Counter-sunk rivets are generally tighter than snapped rivets, because countersinking the hole is really facing it; and the countersunk-rivet is, in point of fact, made on a faced joint. But counter-sinking the hole also weakens the plate, inasmuch as it takes away a portion of the metal, and should only be resorted to where necessary,—such as round the fronts of furnaces, the flanges inside combustion-chambers, and the bottom flanges of steam-chests. In these places it is by no means detrimental; but never countersink any part of the shell of a boiler except those already mentioned, or an odd hole here and there to clear a flange, or something of that sort. Never use a drift in riveting. When bad or unfair holes occur do not put in smaller rivets, but rimer the holes until they become fair and round, and then use rivets to fill them. Always see that the rivet-heads are close up to the plate; and watch the holder-up that he does not hold on the rivet while you are closing the hole, or on the hole while you are finishing the rivet. Do not allow the boy to burn or overheat the rivets. Burnt rivets are always brittle, and liable to break in caulking, especially

when they are made too hot, and then allowed to become too cold before they are hammered. When first the rivet is put in the hole it should be hammered as hard as possible, and fair on the end. If the rivet is hammered lightly, it will not fill the hole; and rivets that are not well upset in the hole never make tight work.

TABLE OF THE LENGTHS OF $\frac{3}{4}$ IN. AND $\frac{5}{8}$ IN. RIVETS FOR MACHINE AND HAND (SNAPPED) RIVETING, TO GO THROUGH TWO THICKNESSES OF PLATE.

Thickness of Plate.	Machine Riveting.	Hand Riveting.
Two $\frac{3}{4}$ in. Plates.	$3\frac{1}{4}$ in. long.	$3\frac{1}{8}$ in. long.
„ $\frac{11}{16}$ „	$3\frac{1}{8}$ „	3 „
„ $\frac{5}{8}$ „	3 „	$2\frac{7}{8}$ „
„ $\frac{9}{16}$ „	$2\frac{5}{8}$ „	$2\frac{1}{2}$ „
„ $\frac{1}{2}$ „	$2\frac{1}{4}$ „	$2\frac{1}{8}$ „
„ $\frac{7}{16}$ „	$2\frac{1}{8}$ „	$1\frac{7}{8}$ „
„ $\frac{3}{8}$ „	$1\frac{7}{8}$ „	$1\frac{3}{4}$ „
„ $\frac{5}{16}$ „	$1\frac{3}{4}$ „	$1\frac{11}{16}$ „

TABLE OF THE LENGTHS OF $\frac{3}{4}$ IN. AND $\frac{3}{8}$ IN. COUNTERSUNK RIVETS TO GO THROUGH TWO THICKNESSES OF PLATE.

Thickness of Plate.	Length of Rivet.
Two $\frac{3}{4}$ in. Plates.	$2\frac{1}{4}$ in. long
" $\frac{11}{16}$ "	2 "
" $\frac{5}{8}$ "	$1\frac{7}{8}$ "
" $\frac{9}{16}$ "	$1\frac{3}{4}$ "
" $\frac{1}{2}$ "	$1\frac{5}{8}$ "
" $\frac{7}{16}$ "	$1\frac{1}{2}$ "
" $\frac{3}{8}$ "	$1\frac{3}{8}$ "
" $\frac{5}{16}$ "	$1\frac{1}{4}$ "

DIMENSIONS OF $\frac{3}{8}$ IN. AND $\frac{7}{16}$ IN. RIVETS FOR HAND-SNAPPING, THROUGH TWO THICKNESSES.

Thickness of Plates.	$\frac{3}{8}$ Rivets.	$\frac{7}{16}$ Rivets.
Two $\frac{1}{4}$ in. Plates.	$1\frac{1}{8}$ in. long.	$1\frac{1}{4}$ in. long.
" $\frac{3}{16}$ "	1 "	$1\frac{1}{8}$ "
" 8 Gauge.	1 "	$1\frac{1}{8}$ "
" $\frac{1}{8}$ "	$\frac{7}{8}$ "	1 "
" 14 "	$\frac{3}{4}$ "	$\frac{7}{8}$ "

Caulking

The object of caulking the edges of plates is to make one lap lay close on the other without any space between them. If the plates were planed perfectly smooth they would be watertight without anything further being done than to keep them close together; but the roughness of the surfaces forms little channels through which the water flows with more or less freedom according to the size of the orifice: therefore, before commencing to caulk, see that the lap is quite close (to the eye); if it is not, take a flogging-hammer and close it. If the edge of the plate has been cut with good shears, it will not want chipping or paring; but if it has been cut with blunt shears, or gapped in shearing, it should be chipped smooth, and a little bevel, viz. to an obtuse angle. Do not caulk with a thin caulking-tool, as it will wedge the lap of the plate away without doing any good. The proper thickness for a caulking-tool for plates from $\frac{3}{8}$ in. to $\frac{7}{8}$ in., inclusive, is $\frac{3}{16}$ in.; above $\frac{7}{8}$ in., $\frac{1}{4}$ in. thick. Never drive wedges or pieces of hoop-iron between the laps if you can possibly avoid it; and do not use sal-ammoniac for rusting the interstices, but trust to your own workmanship. Always caulk the work on the same side as that on which it is riveted, or you will most probably have to caulk all the rivet-heads. Finally, as you caulk, be careful not to go quite the breadth of the tool at each blow, or you will leave little places uncaulked, which will give a deal of trouble in testing. If the caulking-tool is $1\frac{1}{8}$ in. wide, move it full $\frac{7}{8}$ in. at each blow; hold

it level, hammer it hard, do not have any dirt under it on the lap, and the work will be well done. The caulking-tool should be ground a little bevel, say to an angle of 20°, as Fig. 26; and should be worked along the edge of the plate with the long edge outwards; this is called "splitting" the lap; then turn the tool the reverse way, and work back again, and the caulking is completed. One hard blow in each place should be sufficient

Fig 26. Fig. 27 Fig. 28.

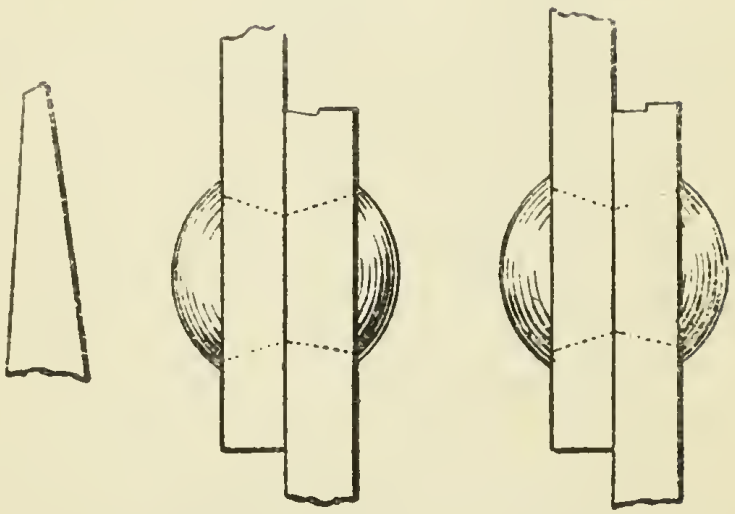


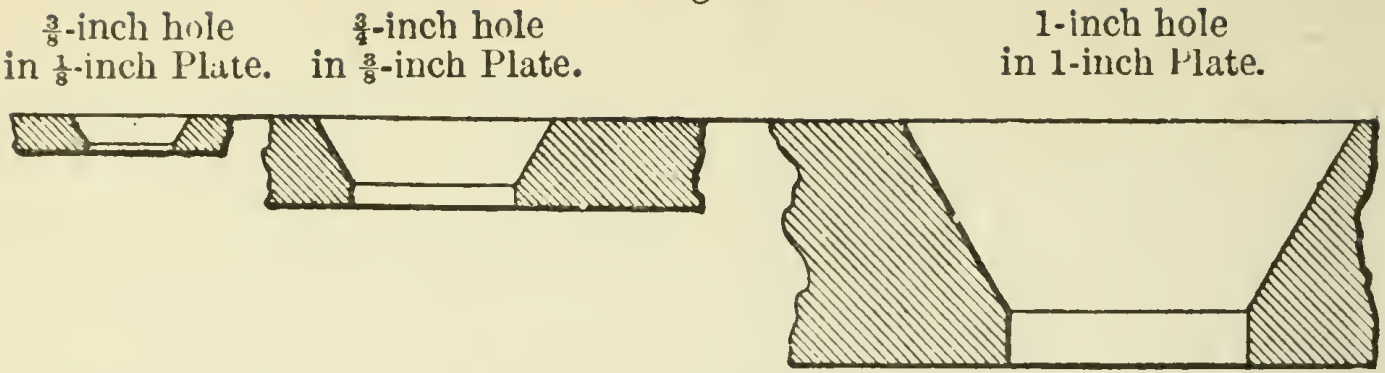
Fig. 26 shows the edge view of a rod caulking-tool. Fig. 27 is the appearance of the lap when split for caulking, and Fig. 28 is the finished appearance of the caulking.

Countersinking.

The object of countersinking is that the heads of the bolts or rivets, as the case may be, shall not project beyond the surface of the plate; and it is desirable that in countersinking the holes an un-

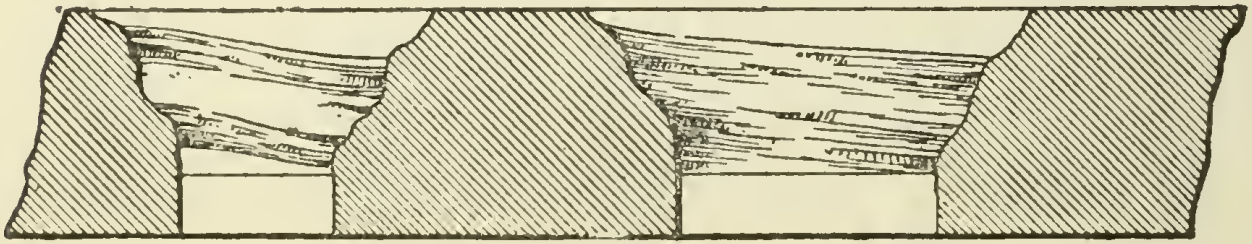
necessary amount of metal should not be taken away, and at the same time to have the rivet-head that fits the countersink sufficiently strong. To arrive at this end, have the countersinking-tool shaped to an angle of 60°, viz. an equilateral triangle, which is formed by joining three straight lines of equal length at their ends. This is the proper angle for all sized holes, large or small. Do not countersink the hole right down to a thin edge, but leave a portion parallel, say, about one-fourth the thickness of the plate, and use some lubricant. Soap-suds are very good, and readily made by dissolving soft-soap in hot water. Never continue to use a broken tool; it will leave projecting rings round the inside of the holes which occasion great difficulty in making the rivets tight.

Fig. 29.



View of holes of different diameters, in different sized plates, all countersunk to the same angle, viz., 60°.

Fig. 30



Appearance of holes countersunk with a broken to l.

CIRCUMFERENCES OF CIRCLES, THICKNESS OF MATERIAL NOT TAKEN INTO ACCOUNT, IN INCHES AND FRACTIONAL PARTS, AND THEIR AREAS IN SQUARE FEET AND INCHES, IN DECIMALS..

Diam.	Circum.	Area.	Area.	Diam.	Circum.	Area.	Area.
inches.	inches.	sq. ft.	sq. in.	inches.	ft. in.	sq. ft.	sq. in.
1	3⅛	..	·7854	3⅜	0 10⅝	..	8·946
1⅛	3½	..	·9940	3½	0 11	..	9·621
1¼	3⅞	..	1·227	3⅝	0 11⅜	..	10·320
1⅜	4¼	..	1·484	3¾	0 11¾	..	11·044
1½	4⅝	..	1·767	3⅞	1 0⅛	..	11·793
1⅝	5⅛	..	2·074	4	1 0½	..	12·566
1¾	5½	..	2·405	4⅛	1 0⅞	..	13·364
1⅞	5⅞	..	2·761	4¼	1 1⅜	..	14·186
2	6¼	..	3·141	4⅜	1 1¾	·1052	15·033
2⅛	6⅝	..	3·546	4½	1 2⅛	·1113	15·904
2¼	7	..	3·976	4⅝	1 2½	·1176	16·800
2⅜	7⅜	..	4·430	4¾	1 2⅞	·1240	17·720
2½	7¾	..	4·908	4⅞	1 3¼	·1306	18·665
2⅝	8¼	..	5·412	5	1 3⅝	·1374	19·635
2¾	8⅝	..	5·939	5⅛	1 4⅛	·1444	20·629
2⅞	9	..	6·491	5¼	1 4½	·1515	21·647
3	9⅜	..	7·068	5⅜	1 4⅞	·1588	22·690
3⅛	9¾	..	7·669	5½	1 5¼	·1663	23·758
3¼	10¼	..	8·295	5⅝	1 5⅝	·1739	24·850

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.	Circum.		Area.	Area.	Diam.	Circum.		Area.	Area.
in.	ft.	in.	sq. in.	sq. ft.	inches.	ft.	in.	sq. in.	sq. ft.
5¾	1	6	25·967	·1817	8⅞	2	3	58·426	·4089
5⅞	1	6⅜	27·108	·1897	8¾	2	3⅜	60·132	·4209
6	1	6¾	28·274	·1979	8⅞	2	3⅞	61·862	·4330
6⅛	1	7¼	29·464	·2062	9	2	4¼	63·617	·4453
6¼	1	7⅜	30·679	·2147	9⅛	2	4⅜	65·396	·4577
6⅜	1	8	31·919	·2234	9¼	2	5	67·200	·4704
6½	1	8⅜	33·183	·2322	9⅜	2	5⅜	69·029	·4832
6⅝	1	8¾	34·471	·2412	9½	2	5¾	70·882	·4961
6¾	1	9⅛	35·784	·2504	9⅝	2	6¼	72·759	·5093
6⅞	1	9½	37·122	·2598	9¾	2	6⅜	74·662	·5226
7	1	10	38·484	·2693	9⅞	2	7	76·588	·5361
7⅛	1	10⅜	39·871	·2791	10	2	7⅜	78·540	·5497
7¼	1	10¾	41·282	·2889	10⅛	2	7¾	80·515	·5636
7⅜	1	11⅛	42·718	·2990	10¼	2	8⅛	82·516	·5776
7½	1	11½	44·178	·3092	10⅜	2	8½	84·540	·5917
7⅝	1	11⅞	45·663	·3196	10½	2	8⅞	86·590	·6061
7¾	2	0⅜	47·173	·3299	10⅝	2	9⅜	88·664	·6206
7⅞	2	0¾	48·707	·3409	10¾	2	9¾	90·762	·6353
8	2	1⅛	50·265	·3518	10⅞	2	10⅛	92·855	·6499
8⅛	2	1½	51·848	·3629	11	2	10½	95·033	·6652
8¼	2	1⅞	53·456	·3741	11⅛	2	10⅞	97·205	·6804
8⅜	2	2¼	55·088	·3856	11¼	2	11¼	99 402	·6958
8½	2	2⅝	56·745	·3972	11⅜	2	11¾	101·623	·7143

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
0	11½	3	0⅛	103·869	·7270	1	2⅜	3	9⅛	162·295	1·1360
0	11⅝	3	0½	106·139	·7429	1	2½	3	9½	165·130	1·1569
0	11¾	3	0⅞	108·434	·7590	1	2⅝	3	9⅞	167·989	1·1749
0	11⅞	3	1¼	110·753	·7752	1	2¾	3	10¼	170·873	1·1961
1	0	3	1⅝	113·097	·7916	1	2⅞	3	10¾	173·782	1·2164
1	0⅛	3	2	115·466	·8082	1	3	3	11⅛	176·715	1·2370
1	0¼	3	2½	117·859	·8250	1	3⅛	3	11½	179·672	1·2577
1	0⅜	3	2⅞	120 276	·8419	1	3¼	3	11⅞	182·654	1·2785
1	0½	3	3¼	122·718	·8590	1	3⅜	4	0¼	185·661	1·2996
1	0⅝	3	3⅝	125·185	·8762	1	3½	4	0⅝	188·692	1·3208
1	0¾	3	4	127·676	·8937	1	3⅝	4	1	191·748	1·3422
1	0⅞	3	4⅜	130·192	·9113	1	3¾	4	1½	194·828	1·3637
1	1	3	4¾	132·732	·9291	1	3⅞	4	1⅞	197·933	1·3855
1	1⅛	3	5¼	135·297	·9470	1	4	4	2¼	201·062	1·4074
1	1¼	3	5⅝	137·886	·9642	1	4⅛	4	2⅝	204·216	1·4295
1	1⅜	3	6	140·500	·9835	1	4¼	4	3	207·394	1·4517
1	1½	3	6⅜	143·139	1·0019	1	4⅜	4	3⅜	210·597	1·4741
1	1⅝	3	6¾	145·802	1·0206	1	4½	4	3¾	213·825	1·4967
1	1¾	3	7⅛	148·489	1·0294	1	4⅝	4	4¼	217·077	1·5195
1	1⅞	3	7½	151·201	1·0588	1	4¾	4	4⅝	220·353	1·5424
1	2	3	7⅞	153·938	1·0775	1	4⅞	4	5	223·654	1·5655
1	2⅛	3	8⅜	156·699	1·0968	1	5	4	5⅜	226·980	1·5888
1	2¼	3	8¾	159·485	1·1193	1	5⅛	4	5¾	230·330	1·6123

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
1	5¼	4	6⅛	233·705	1·6359	1	8⅛	5	3¼	318·099	2·2265
1	5⅜	4	6½	237·104	1·6597	1	8¼	5	3⅜	322·063	2·2543
1	5½	4	6⅞	240·528	1·6836	1	8⅜	5	4	326·051	2·2822
1	5⅝	4	7⅜	243·977	1·7078	1	8½	5	4⅜	330·064	2·3103
1	5¾	4	7¾	247·450	1·7321	1	8⅝	5	4¾	334·101	2·3386
1	5⅞	4	8⅛	250·947	1·7566	1	8¾	5	5⅛	338·163	2·3670
1	6	4	8½	254·469	1·7812	1	8⅞	5	5½	342·250	2·3956
1	6⅛	4	8⅞	258·016	1·8061	1	9	5	5⅞	346·361	2·4244
1	6¼	4	9¼	261·587	1·8311	1	9⅛	5	6⅜	350·497	2·4533
1	6⅜	4	9¾	265·182	1·8562	1	9¼	5	6¾	354·657	2·4824
1	6½	4	10⅛	268·803	1·8816	1	9⅜	5	7⅛	358·841	2·5117
1	6⅝	4	10½	272·447	1·9071	1	9½	5	7½	363·051	2·5412
1	6¾	4	10⅞	276·117	1·9328	1	9⅝	5	7⅞	367·284	2·5703
1	6⅞	4	11¼	279·811	1·9586	1	9¾	5	8¼	371·543	2·6007
1	7	4	11⅝	283·529	1·9847	1	9⅞	5	8¾	375·826	2·6306
1	7⅛	5	0	287·272	1·9941	1	10	5	9⅛	380 133	2·6608
1	7¼	5	0½	291·039	2·0371	1	10⅛	5	9½	384·465	2 6691
1	7⅜	5	0⅞	294·831	2·0637	1	10¼	5	9⅞	388·822	2·7016
1	7½	5	1¼	298·648	2·0904	1	10⅜	5	10¼	393·203	2·7224
1	7⅝	5	1⅝	302·489	2·1172	1	10½	5	10⅝	397·608	2·7632
1	7¾	5	2	306·355	2·1443	1	10⅝	5	11	402·038	2·7980
1	7⅞	5	2⅜	310·245	2·1716	1	10¾	5	11½	406·493	2·8054
1	8	5	2⅞	314·160	2·1990	1	10⅞	5	11⅞	410·972	2·8658

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
1	11	6	0¼	415·476	2·8903	2	1⅞	6	9¼	525·849	3·6485
1	11⅛	6	0⅝	420·004	2·9100	2	2	6	9⅝	530·930	3·6870
1	11¼	6	1	424·557	2·9518	2	2⅛	6	10	536·059	3·7226
1	11⅜	6	1⅜	429·135	2·9937	2	2¼	6	10½	541·189	3·7583
1	11½	6	1¾	433·737	3·0129	2	2⅜	6	10¾	546·368	3·7942
1	11⅝	6	2¼	438·363	3·0261	2	2½	6	11¼	551·547	3·8302
1	11¾	6	2⅝	443·014	3·0722	2	2⅝	6	11⅝	556·774	3·8672
1	11⅞	6	3	447·690	3·1081	2	2¾	7	0	562·002	3 9042
2	0	6	3⅜	452·390	3·1418	2	2⅞	7	0⅜	567·279	3·9401
2	0⅛	6	3¾	457·127	3·1746	2	3	7	0¾	572·556	3·9761
2	0¼	6	4⅛	461·864	3·2075	2	3⅛	7	1⅛	577·882	4·0130
2	0⅜	6	4½	466 650	3·2403	2	3¼	7	1⅝	583·208	4·0500
2	0½	6	4⅞	471·436	3·2731	2	3⅜	7	2	588·583	4·0870
2	0⅝	6	5¼	476·271	3·3070	2	3½	7	2⅜	593·958	4·1241
2	0¾	6	5¾	481·106	3·3410	2	3⅝	7	2¾	599·382	4·1620
2	0⅞	6	6⅛	485·990	3·3745	2	3¾	7	3⅛	604·807	4·2000
2	1	6	6½	490·875	3·4081	2	3⅞	7	3½	610·280	4·2380
2	1⅛	6	6⅞	495·808	3·4428	2	4	7	3⅞	615·753	4·2760
2	1¼	6	7¼	500·741	3·4775	2	4⅛	7	4¼	621·275	4·3140
2	1⅜	6	7⅝	505·723	3 5121	2	4¼	7	4¾	626·798	4·3521
2	1½	6	8⅛	510 706	3·5468	2	4⅜	7	5⅛	632·369	4·3911
2	1⅝	6	8⅝	515·737	3·5121	2	4½	7	5½	637·941	4·4302
2	1¾	6	8⅞	520·769	3·6101	2	4⅝	7	5⅞	643·561	4·4692

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
2	4¾	7	6¼	649·182	4·5083	2	7⅝	8	3¼	785·522	5·4547
2	4⅞	7	6⅝	654·851	4·5472	2	7¾	8	3¾	791·732	5·4932
2	5	7	7	660·521	4·5861	2	7⅞	8	4⅛	797·991	5·5416
2	5⅛	7	7½	666·239	4·6263	2	8	8	4½	804·249	5·5850
2	5¼	7	7⅞	671·958	4·6665	2	8⅛	8	5	810·557	5·6289
2	5⅜	7	8¼	677·726	4·7066	2	8¼	8	5⅜	816·865	5·6729
2	5½	7	8⅝	683·494	4·7467	2	8⅜	8	5¾	823·221	5·7165
2	5⅝	7	9	689·811	4·7870	2	8½	8	6⅛	829·578	5·7601
2	5¾	7	9½	695·128	4·8274	2	8⅝	8	6½	835·984	5·8046
2	5⅞	7	9¾	700·994	4·8677	2	8¾	8	6⅞	842·390	5 8491
2	6	7	10¼	706·860	4·9081	2	8⅞	8	7¼	848·845	5·8944
2	6⅛	7	10⅝	712·775	4·9491	2	9	8	7⅝	855·300	5·9398
2	6¼	7	11	718·690	4·9901	2	9⅛	8	8	861·804	5·9844
2	6⅜	7	11⅜	724·654	5·0316	2	9¼	8	8½	868·308	6·0291
2	6½	7	11¾	730·618	5·0731	2	9⅜	8	8⅞	874·861	6·0746
2	6⅝	8	0⅛	736·631	5·1152	2	9½	8	9¼	881·415	6·1201
2	6¾	8	0⅝	742·644	5·1573	2	9⅝	8	9⅝	888·417	6·1665
2	6⅞	8	1	748·706	5·1925	2	9¾	8	10	894·619	6·2129
2	7	8	1⅜	754·769	5·2278	2	9⅞	8	10⅜	901·270	6·2590
2	7⅛	8	1¾	760·880	5·2771	2	10	8	10¾	907·922	6·3051
2	7¼	8	2⅛	766·992	5·3264	2	10⅛	8	11⅛	914·622	6·3516
2	7⅜	8	2½	773·152	5·3688	2	10¼	8	11½	921·323	6·3981
2	7½	8	2⅞	779·313	5·4112	2	10⅜	8	11⅞	928·072	6·4446

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
2	10½	9	0⅜	934·822	6·4911	3	1⅜	9	9½	1097·12	7·6181
2	10⅝	9	0¾	941·621	6·5387	3	1½	9	9⅞	1104·46	7·6691
2	10¾	9	1⅛	948·419	6·5863	3	1⅝	9	10¼	1111·85	7·7241
2	10⅞	9	1½	955·267	6·6339	3	1¾	9	10⅝	1119·24	7·7791
2	11	9	1⅞	962·115	6 6815	3	1⅞	9	11	1126·68	7·8236
2	11⅛	9	2⅜	969·011	6·7293	3	2	9	11⅜	1134·12	7·8681
2	11¼	9	2¾	975·908	6·7772	3	2⅛	9	11¾	1141·60	7·9236
2	11⅜	9	3⅛	982·854	6·8255	3	2¼	10	0⅛	1149·09	7·9791
2	11½	9	3½	989·800	6·8738	3	2⅜	10	0½	1156·62	8·0318
2	11⅝	9	3⅞	996 795	6 9219	3	2½	10	0⅞	1164·16	8·0846
2	11¾	9	4¼	1003·79	6·9701	3	2⅝	10	1⅜	1171·74	8·1368
2	11⅞	9	4⅝	1010·83	7·0194	3	2¾	10	1¾	1179·32	8·1891
3	0	9	5	1017·87	7·0683	3	2⅞	10	2⅛	1186·95	8·2421
3	0⅛	9	5½	1024·96	7·1179	3	3	10	2¼	1194·59	8·2951
3	0¼	9	5⅞	1032·06	7·1671	3	3⅛	10	2⅞	1202·27	8·3488
3	0⅜	9	6¼	1039·20	7·2167	3	3¼	10	3¼	1209·95	8·4026
3	0½	9	6⅝	1046·35	7·2664	3	3⅜	10	3⅝	1222·68	8·4558
3	0⅝	9	7	1053·54	7·3163	3	3½	10	4	1225·42	8·5091
3	0¾	9	7½	1060·73	7·3662	3	3⅝	10	4½	1233·20	8·5631
3	0⅞	9	7⅞	1067·97	7·4161	3	3¾	10	4⅞	1240·98	8·6171
3	1	9	8¼	1075·21	7·4661	3	3⅞	10	5¼	1248·81	8·6720
3	1⅛	9	8⅝	1082·50	7·5166	3	4	10	5⅝	1256·64	8·7269
3	1¼	9	9	1089 79	7·5671	3	4⅛	10	6	1264·51	8·7815

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
3	4¼	10	6⅜	1272·39	8·8361	3	7⅛	11	3½	1460·67	10·143
3	4⅜	10	6¾	1280·32	8·8911	3	7¼	11	3⅞	1469·14	10·202
3	4½	10	7¼	1288·25	8·9462	3	7⅜	11	4¼	1477·65	10·266
3	4⅝	10	7⅝	1296·22	9·0011	3	7½	11	4⅝	1486·17	10·320
3	4¾	10	8	1304·20	9·0561	3	7⅝	11	5	1494·73	10·379
3	4⅞	10	8⅜	1312·22	9·1123	3	7¾	11	5⅜	1503·30	10·439
3	5	10	8¾	1320·25	9·1686	3	7⅞	11	5¾	1511·91	10·499
3	5⅛	10	9⅛	1328·32	9·1399	3	8	11	6¼	1520·53	10·559
3	5¼	10	9½	1336·40	9·2112	3	8⅛	11	6⅝	1529 19	10 619
3	5⅜	10	9⅞	1344·52	9·3024	3	8¼	11	7	1537·86	10·679
3	5½	10	10⅜	1352·65	9·3936	3	8⅜	11	7⅜	1546·57	10·739
3	5⅝	10	10¾	1360·82	9·4498	3	8½	11	7¾	1555·28	10·800
3	5¾	10	11⅛	1369·00	9·5061	3	8⅝	11	8⅛	1564·04	10·861
3	5⅞	10	11½	1377·22	9·5636	3	8¾	11	8½	1572·81	10·922
3	6	10	11⅞	1385·44	9·6212	3	8⅞	11	8⅞	1581·62	10·983
3	6⅛	11	0⅜	1393·71	9·6788	3	9	11	9⅜	1590·43	11·044
3	6¼	11	0¾	1401·98	9·7364	3	9⅛	11	9¾	1599·29	11·105
3	6⅜	11	1⅛	1410·30	9·7941	3	9¼	11	10⅛	1608·15	11·167
3	6½	11	1½	1418·62	9·8518	3	9⅜	11	10½	1617·06	11·229
3	6⅝	11	1⅞	1426·99	9·9094	3	9½	11	10⅞	1625·97	11·291
3	6¾	11	2¼	1435·36	9·9671	3	9⅝	11	11⅜	1634·93	11·353
3	6⅞	11	2⅝	1443·78	10·0255	3	9¾	11	11¾	1643·89	11·415
3	7	11	3	1452·20	10·084	3	9⅞	12	0⅛	1652·89	11·474

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
3	10	12	0½	1661·90	11·534	4	0⅞	12	9½	1876·14	13·028
3	10⅛	12	0⅞	1670·96	11·600	4	1	12	9⅞	1885·74	13·095
3	10¼	12	1¼	1680·02	11·666	4	1⅛	12	10⅜	1895·38	13·162
3	10⅜	12	1⅝	1689·12	11·729	4	1¼	12	10¾	1905·03	13·229
3	10½	12	2	1698·23	11·793	4	1⅜	12	11⅛	1914·72	13·296
3	10⅝	12	2½	1707·38	11·856	4	1½	12	11½	1924·42	13·364
3	10¾	12	2⅞	1716·54	11·920	4	1⅝	12	11⅞	1934·16	13·431
3	10⅞	12	3¼	1725·74	11·984	4	1¾	13	0¼	1943·91	13·499
3	11	12	3⅜	1734·94	12·048	4	1⅞	13	0⅝	1953·70	13·567
3	11⅛	12	4	1744·09	12·112	4	2	13	1	1963·50	13·635
3	11¼	12	4⅜	1753·45	12·176	4	2⅛	13	1½	1973·34	13·703
3	11⅜	12	4⅞	1762·75	12·240	4	2¼	13	1⅞	1983·18	13·772
3	11½	12	5¼	1772·05	12·305	4	2⅜	13	2¼	1993·07	13·840
3	11⅝	12	5⅝	1781·40	12·370	4	2½	13	2⅝	2002·96	13·909
3	11¾	12	6	1790·76	12·435	4	2⅝	13	3	2012·90	13·978
3	11⅞	12	6⅜	1800·16	12·500	4	2¾	13	3⅜	2022·84	14·047
4	0	12	6¾	1809·56	12·566	4	2⅞	13	3⅞	2032·83	14·116
4	0⅛	12	7⅛	1819·01	12·631	4	3	13	4¼	2042·82	14·186
4	0¼	12	7½	1828·46	12·697	4	3⅛	13	4⅝	2052·86	14·255
4	0⅜	12	8	1837·95	12·763	4	3¼	13	5	2062·90	14·325
4	0½	12	8⅜	1847·45	12·829	4	3⅜	13	5⅜	2072·98	14·395
4	0⅝	12	8¾	1857·00	12·895	4	3½	13	5¾	2083·07	14·465
4	0¾	12	9⅛	1866·55	12·962	4	3⅝	13	6⅛	2093·21	14·535

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
4	3¾	13	6½	2103·35	14·606	4	6⅝	14	3⅝	2343·55	16·274
4	3⅞	13	7	2113·53	14·675	4	6¾	14	4	2354·28	16·349
4	4	13	7⅜	2123·72	14·748	4	6⅞	14	4⅜	2365·05	16·423
4	4⅛	13	7¾	2133·95	14·819	4	7	14	4¾	2375·83	16·498
4	4¼	13	8⅛	2144·19	14·890	4	7⅛	14	5⅛	2386 65	16·573
4	4⅜	13	8½	2154·47	14·961	4	7¼	14	5½	2397·48	16·649
4	4½	13	8⅞	2164·75	15·033	4	7⅜	14	6	2408·35	16·724
4	4⅝	13	9⅜	2175·08	15·104	4	7½	14	6⅜	2419·22	16·800
4	4¾	13	9¾	2185·42	15·176	4	7⅝	14	6¾	2430·14	16·875
4	4⅞	13	10⅛	2195·80	15·248	4	7¾	14	7⅛	2441·07	16·951
4	5	13	10½	2206·18	15·320	4	7⅞	14	7½	2452·04	17·027
4	5⅛	13	10⅞	2216·61	15·392	4	8	14	7⅞	2463·01	17·104
4	5¼	13	11¼	2227·05	15·465	4	8⅛	14	8¼	2474·03	17·180
4	5⅜	13	11⅝	2237·53	15·538	4	8¼	14	8⅝	2485·05	17·257
4	5½	14	0	2248·01	15·611	4	8⅜	14	9⅛	2496·12	17·334
4	5⅝	14	0½	2258·53	15·684	4	8½	14	9½	2507·19	17·411
4	5¾	14	0⅞	2269·06	15·757	4	8⅝	14	9⅞	2518·30	17·488
4	5⅞	14	1¼	2279·64	15·830	4	8¾	14	10¼	2529·42	17·565
4	6	14	1⅝	2290·22	15·904	4	8⅞	14	10⅝	2540·59	17·642
4	6⅛	14	2	2300·85	15·977	4	9	14	11	2551·76	17·720
4	6¼	14	2⅜	2311·48	16·051	4	9⅛	14	11½	2562·97	17·798
4	6⅜	14	2⅞	2322·15	16·125	4	9¼	14	11⅞	2574·19	17·876
4	6½	14	3¼	2332·83	16·200	4	9⅜	15	0¼	2571·95	17·954

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
4	9½	15	0⅝	2596·72	18·033	5	3¼	16	6¼	3142·04	21·819
4	9¾	15	1⅜	2619·35	18·189	5	3½	16	7½	3166·92	21·992
4	10	15	2¼	2642·08	18·347	5	3¾	16	8¼	3191·91	22·166
4	10¼	15	2⅞	2664·91	18·506	5	4	16	9	3216·99	22·333
4	10½	15	3¾	2687·83	18·665	5	4¼	16	9¾	3242·17	22·515
4	10¾	15	4½	2710·85	18·885	5	4½	16	10⅝	3267·46	22·621
4	11	15	5¼	2733·97	18·985	5	4¾	16	11⅜	3292·83	22·866
4	11¼	15	6⅛	2757·19	19·147	5	5	17	0⅛	3318·31	23·043
4	11½	15	6⅞	2780·51	19 309	5	5¼	17	0⅞	3343·88	23·221
4	11¾	15	7¾	2803·92	19·471	5	5½	17	1¾	3369·56	23·330
5	0	15	8½	2827·44	19·635	5	5¾	17	2½	3395·33	23·578
5	0¼	15	9¼	2851·05	19·798	5	6	17	3⅜	3421·20	23·758
5	0½	15	10	2874·76	19·963	5	6¼	17	4⅛	3447·16	23·938
5	0¾	15	10¾	2898·56	20·128	5	6½	17	4⅞	3473·23	24·119
5	1	15	11⅝	2922·47	20·294	5	6¾	17	5⅝	3499·39	24·301
5	1¼	16	0⅜	2946·47	20·461	5	7	17	6½	3525·66	24·483
5	1½	16	1¼	2970·57	20·629	5	7¼	17	7¼	3552·01	24·666
5	1¾	16	1⅞	2994·77	20·797	5	7½	17	8	3578·47	24·850
5	2	16	2¾	3019 07	20·965	5	7¾	17	8¾	3605·03	25·034
5	2¼	16	3½	3043·47	21·135	5	8	17	9⅝	3631·68	25·220
5	2½	16	4¼	3067·96	21·305	5	8¼	17	10⅜	3658·44	25·405
5	2¾	16	5⅛	3092·56	21·476	5	8½	17	11⅛	3685·29	25·592
5	3	16	5⅞	3117·25	21·647	5	8¾	17	11⅞	3712·24	25·779

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
5	9	18	0¾	3739·28	25·964	6	2¾	19	6¾	4388·47	30·475
5	9¼	18	1½	3766·43	26·155	6	3	19	7⅝	4417·87	30·679
5	9½	18	2¼	3793·67	26·344	6	3¼	19	8⅜	4447·37	30·884
5	9¾	18	3⅛	3821·02	26·534	6	3½	19	9⅛	4476·97	31·090
5	10	18	3⅞	3848·46	26·725	6	3¾	19	9⅞	4506·67	31·296
5	10¼	18	4⅝	3875·99	26·916	6	4	19	10¾	4536·47	31·503
5	10½	18	5½	3903·63	27·108	6	4¼	19	11½	4566·36	31·710
5	10¾	18	6¼	3931·36	27·301	6	4½	20	0¼	4596·35	31·919
5	11	18	7	3959·20	27·494	6	4¾	20	1⅛	4626·44	32·114
5	11¼	18	7¾	3987·13	27·688	6	5	20	1⅞	4656·63	32·337
5	11½	18	8⅝	4015·16	27·883	6	5¼	20	2⅝	4686·92	32·548
5	11¾	18	9⅜	4043·28	28·078	6	5½	20	3½	4717·30	32·759
6	0	18	10⅛	4071·51	28·274	6	5¾	20	4¼	4747·79	32·970
6	0¼	18	10⅞	4099·83	28·471	6	6	20	5	4778·37	33·183
6	0½	18	11¾	4128·25	28·668	6	6¼	20	5¾	4809·05	33·396
6	0¾	19	0½	4156·77	28·866	6	6½	20	6½	4839·83	33·619
6	1	19	1¼	4185·39	29·065	6	6¾	20	7⅜	4870·70	33·824
6	1¼	19	2⅛	4214·11	29·264	6	7	20	8⅛	4901·68	34·039
6	1½	19	2⅞	4242·92	29·466	6	7¼	20	8⅞	4932·75	34·255
6	1¾	19	3⅝	4271·83	29·665	6	7½	20	9¾	4963·92	34·471
6	2	19	4½	4300·85	29·867	6	7¾	20	10½	4995·19	34·688
6	2¼	19	5¼	4329·95	30·069	6	8	20	11¼	5026·26	34·906
6	2½	19	6	4359·16	30·271	6	8¼	21	0⅛	5058·02	35·125

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq ft.	ft.	in.	ft	in.	sq. in.	sq. ft.
6	8½	21	0⅞	5089·58	35·344	7	9	24	4⅛	..	47·1730
6	8¾	21	1⅛	5121·24	35·564	7	10	24	7¼	..	48·1926
6	9	21	2⅜	5153·00	35·784	7	11	24	10⅜	..	49·2236
6	9¼	21	3¼	5184·86	36·006	8	0	25	1½	..	50·2650
6	9½	21	4	5216·82	36·227	8	1	25	4⅝	..	51·3178
6	9¾	21	4¾	5248·87	36·450	8	2	25	7⅞	..	52·3816
6	10	21	5½	5281·02	36·674	8	3	25	11	..	53·4562
6	10¼	21	6⅜	5313·27	36·897	8	4	26	2⅛	..	54·5412
6	10½	21	7⅛	5345·62	37·122	8	5	26	5¼	..	55·6377
6	10¾	21	7⅞	5378·07	37·347	8	6	26	8⅜	..	56·7451
6	11	21	8¾	5410·62	37·573	8	7	26	11½	..	57·8628
6	11¼	21	9½	5443·26	37·700	8	8	27	2¾	..	58·9920
6	11½	21	10¼	5476·00	38·027	8	9	27	5¾	..	60·1321
6	11¾	21	11	5508·84	38·256	8	10	27	9	..	61·2826
7	0	21	11⅞	5541·78	38·4846	8	11	28	0⅛	..	62·4445
7	1	22	3	..	39 4060	9	0	28	3¼	..	63·6174
7	2	22	6⅛	..	40·3388	9	1	28	6⅜	..	64·8006
7	3	22	9¼	..	41·2825	9	2	28	9½	..	65·9951
7	4	23	0⅜	..	42·2367	9	3	29	0⅝	..	67·2007
7	5	23	2⅛	..	43·2022	9	4	29	3¾	..	68·4166
7	6	23	6¾	..	44·1787	9	5	29	7	..	69·6440
7	7	23	11	..	45·1656	9	6	29	10⅛	..	70·8823
7	8	24	1⅛	..	46·1638	9	7	30	1¼	..	72·1309

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
9	8	30	4⅜	..	73·3910	11	7	36	4½	..	105·3794
9	9	30	7½	..	74·6620	11	8	36	7¾	..	106·9013
9	10	30	11⅝	..	75·9433	11	9	36	10⅞	..	108·4342
9	11	31	1¾	..	77·2362	11	10	37	2¼	..	109·9772
10	0	31	5	..	78·5400	11	11	37	5¼	..	111·5319
10	1	31	8⅛	..	79·8540	12	0	37	8⅜	..	113·0976
10	2	31	11¼	..	81·1795	12	1	37	11½	..	114·6732
10	3	32	2⅜	..	82·5160	12	2	38	2⅝	..	116·2607
10	4	32	5½	..	83·8627	12	3	38	5¾	..	117·8590
10	5	32	8⅝	..	85·2211	12	4	38	8⅞	..	119·4674
10	6	32	11¾	..	86·5903	12	5	39	0	..	121·0876
10	7	33	2⅞	..	87·9697	12	6	39	3¼	..	122·7187
10	8	33	6⅛	..	89·3608	12	7	39	6⅜	..	124·3598
10	9	33	9¼	..	90·7627	12	8	39	9½	..	126·0127
10	10	34	0⅜	..	92·1749	12	9	40	0⅝	..	127·6765
10	11	34	3½	..	93·5986	12	10	40	3¾	..	129·3504
11	0	34	6⅝	..	95·0334	12	11	40	6⅞	..	131·0360
11	1	34	9¾	..	96·4783	13	0	40	10	..	132·7326
11	2	35	0⅞	..	97·9347	13	1	41	1⅛	..	134·4391
11	3	35	4⅛	..	99·4021	13	2	41	4⅜	..	136·1574
11	4	35	7¼	..	100·8797	13	3	41	7½	..	137·8867
11	5	35	10⅝	..	102·3689	13	4	41	10⅝	..	139·6260
11	6	36	1½	..	103·8691	13	5	42	1⅝	..	141·3771

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

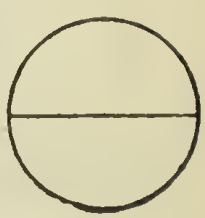
Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in	sq. in.	sq. ft.
13	6	42	4⅞	..	143·1391	15	5	48	5⅛	..	186·6684
13	7	42	8	..	144·9111	15	6	48	8¼	..	188·6923
13	8	42	11⅛	..	146·6949	15	7	48	11⅜	..	190·7260
13	9	43	2¼	..	148·4896	15	8	49	2⅝	..	192·7716
13	10	43	5½	..	150·2943	15	9	49	5¾	..	194·8282
13	11	43	8⅝	..	152 1109	15	10	49	8⅞	..	196·8946
14	0	43	11¾	..	153·9384	15	11	50	0	..	198·9730
14	1	44	2⅞	..	155·7758	16	0	50	3⅛	..	201·0624
14	2	44	6	..	157·6250	16	1	50	6¼	..	203·1615
14	3	44	9⅛	..	159·4852	16	2	50	9⅝	..	205·2726
14	4	45	0¼	..	161·3553	16	3	51	0½	..	207·3916
14	5	45	3½	..	163·2373	16	4	51	3¾	..	209·5264
14	6	45	6⅝	..	165·1303	16	5	51	6½	..	211·6703
14	7	45	9¾	..	167·0331	16	6	51	10	..	213·8251
14	8	46	0⅞	..	168·9479	16	7	52	1⅛	..	215·9896
14	9	46	4	..	170·8735	16	8	52	4¼	..	218·1662
14	10	46	7⅛	..	172·8091	16	9	52	7⅜	..	220·3537
14	11	46	11¼	..	174·7565	16	10	52	10½	..	222·5510
15	0	47	1½	..	176·7150	16	11	53	1⅝	..	224·7603
15	1	47	4⅝	..	178·6832	17	0	53	4⅞	..	226·9806
15	2	47	7¾	..	180·6634	17	1	53	8	..	229·2105
15	3	47	10⅞	..	182·6545	17	2	53	11⅛	..	231·4625
15	4	48	2½	..	184·6555	17	3	54	2⅛	..	233·7055

CIRCUMFERENCES AND AREAS OF CIRCLES—*continued.*

Diam.		Circum.		Area.	Area.	Diam.		Circum.		Area.	Area.
ft.	in.	ft.	in.	sq. in.	sq. ft.	ft.	in.	ft.	in.	sq. in.	sq. ft.
17	4	54	5⅜	..	235·9682	18	2	57	0⅞	..	259·2033
17	5	54	8½	..	238·2430	18	3	57	4	..	261·5872
17	6	54	11⅝	..	240·5287	18	4	57	7⅛	..	263·9807
17	7	55	2⅞	..	242·8241	18	5	57	10¼	..	266·3864
17	8	55	6	..	245·1316	18	6	58	1⅜	..	268·8031
17	9	55	9⅛	..	247·4500	18	7	58	4½	..	271·2293
17	10	56	0¼	..	249·7781	18	8	58	7⅝	..	273·6678
17	11	56	3½	..	252·1184	18	9	58	10¾	..	276·1171
18	0	56	6½	..	254·4696	18	10	59	2	..	278·5761
18	1	56	9⅝	..	256·8303	18	11	59	5⅛	..	281·0472

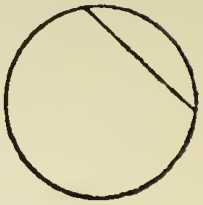
PROPERTIES OF THE CIRCLE.

A circular vessel will contain a greater quantity than a vessel of any other shape, made of the same amount of material: that is to say, if an iron plate 10 feet long was rolled into a cylinder, and a bottom put in it, it would hold more water than if the 10-feet plate had been bent square, or any other shape. The areas of circles are to each other as the squares of their diameters. Any circle twice the diameter of another is also four times its area, and twice its circumference. The diameter of a circle is a straight line drawn through its centre, touching both sides, thus:—

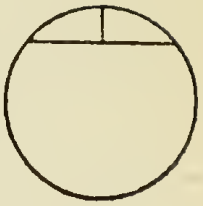


The radius of a circle is half the diameter, or the distance from the centre to the perimeter, thus :—

A chord is a straight line joining any two places in the circumference or perimeter, thus :—



The versed sine is a perpendicular joining the middle of the chord and circumference, thus :—



An arc is any part of a circumference, thus :—

Multiply the diameter by 3·1416, and the product is the circumference.

Multiply the circumference by ·31831, and the result is the diameter.

Multiply the square of the diameter—that is to say, the diameter multiplied by itself—by ·7854, and the product is the area

Multiply the square root of the area by 1·12837, and the product is the diameter.

Multiply the diameter by ·8862, and the product is the side of a square of equal area.

Multiply the side of a square by 1·128, and the product is the diameter of a circle of equal area.

Repairing Boilers.

It is commonly noticed in boilers that have seams of rivets exposed to the action of the fire, that after being at work for some time, cracks begin to appear, running from the rivets towards the centre of the plate. The cause is, that one lap being covered by another prevents the water from getting to the one nearest the fire; consequently the lap nearest the fire becomes hotter, and expands to a much greater extent than any other part of the plate, and its constant unequal expansion and contraction, as the boiler becomes alternately hot and cold, inevitably results in a crack. These cracks may be temporarily repaired by drilling a hole in the bottom or extremity of them, so that the crack is completely drilled out; and, as a rule, this may be safely done if the crack is not more than 3 inches long, but if of greater length, do not tamper with it, but have the plate out, if possible. If it is not practicable to take the plate out, cut out so large a piece that the seams of the patch shall be as far from the fire as possible. Let it be well borne in mind that, in addition to the two laps causing unequal expansion, the sediment or scale inside the boiler obstinately sticks in between the rivet-heads and under the edge of the lap, from whence it is seldom or never properly removed in cleaning the boiler. After drilling out the end of the crack, countersink the drilled hole, and also the hole in the seam above it; so that when rivets are again put in, they will meet each other, or nearly so. Let the heads of these rivets be as thin as pos-

sible, so as not again to retain the heat, or attract or harbour the dirt. Sometimes it will be observed that a crack in the seam is running from hole to hole between the rivets. This is always dangerous, and the cracked plate should be cut out and replaced by a new one as soon as possible. In putting patches on any part of a boiler, never cut a hole out with square corners, like the inside of a picture-frame; but cut the holes which are to be covered with a patch round, or as nearly circular as possible. But it is always better "not to put a patch on," but to cut out the defective plate and put in a new one, thus making the boiler as nearly as possible what it was when new. In putting a new plate in a very old boiler, it is advisable to have it a little thinner than the old plates were when new, say $\frac{1}{16}$th of an inch. In putting on a new plate, arrange it, if possible, so that the caulking shall be done on the new iron; but never place the edge of the laps towards the fire, unless a considerable distance from it. After repairing the boiler, test it with cold water to double the working pressure; viz. if the boiler is worked to a pressure of 50 lbs. per square inch, test it to 100 lbs., &c. And in testing the boiler, notice if the top of the furnace-tubes have any tendency to become flat. This is easily ascertained by placing two laths in the middle of the tube in the form of a cross, that is to say, one vertically and one horizontally. If the tube is giving way to the pressure, the vertical lath will bend, and the horizontal one will drop, as the tube assumes an oval shape, the horizontal diameter being the longest. If this occurs, the

tube should be strengthened, either with a ring or a Galloway pipe; if with a ring, keep a space between it and the tube, as before explained, and pitch the rivets about 8 inches from centre to centre.

Advice to Steam Users.

When a person contemplates having a new boiler made, it is not by any means advisable to write to all the boiler-makers in the 'Directory,' asking them for estimates, and then to give the order to the lowest tender. If you do so, you will often find yourself in the hands of needy persons, who, in their anxiety to get an order, will sometimes ask really less than they can make the article for; and to compensate themselves by some means, will take every possible advantage; and at the very best, will leave such a very little margin of safety, that you will be always in the position of a person sitting on a charged mine. The most prudent course is to apply to some of your friends who are old steam users, and enquire whose boilers they prefer, and why; and use your own discretion afterwards as to whether you ask estimates from a select few, or at once give the order to a respectable firm. Do not delay giving the order to the last moment, and then insist that it shall be done by a certain date, under a penalty of so much a-day for every day over and above the specified time. Such a clause often causes manufacturers, or their foremen, to pass over bad or doubtful workmanship, where they otherwise certainly would not do so. Whatever way, or to whomsoever you give the order,

know beforehand the exact description of boiler and quality of material you are to have; and for which purpose the following copies of specifications will be found useful:—Always have your boiler fitted with efficient fusible plugs, and with glass water-indicators; they are the windows of the boiler, through which you can always see whether or not there is a sufficiency of water inside.

SPECIFICATION OF 30-HORSE POWER LANCASHIRE OR DOUBLE FLUED BOILER FOR MESSRS. BROWN, JONES & CO.

SHELL.

The shell of the boiler shall be 28 ft. long by 6 ft. 6 in. diameter, $\frac{1}{2}$ an inch thick. It shall consist of seven tiers or rings of plates; the two end rings 3 ft. 10 in. wide each from centre to centre of rivet-holes, and the other five tiers 4 ft. wide each from centre to centre of rivet-holes, making 27 ft. 8 in. of total length from centre to centre of rivet-holes. All the longitudinal seams shall be double-riveted 2 inches pitch, and the circular seams single-riveted. The outside tiers shall be all 2 inches pitch from centre to centre of rivet-holes; the two end tiers shall be lapped outside, and the other five shall be alternately inside and outside, viz. four outside tiers and three inside tiers. Not any of the shell-plates to be made taper. The plates to be of the best Staffordshire iron, and the brand to be visible on the outside of each plate; and in no case shall there be less than $\frac{3}{4}$ths of an inch between the edge of the rivet-holes and the edge of the plate.

Tubes.

The boiler shall contain two tubes, each to be 2 ft. 6 in. diameter by $\frac{3}{8}$ths of an inch thick, and the same length as the shell. The front top plate to be of Lowmoor or Bowling iron, to be 10 ft. long, and of sufficient width to bring each edge 6 in. below the centre of the tube. Both side-laps to be inside the tube; that is to say, the plate over the fire shall not have any of its laps covered by any other lap, so that it can be easily removed for repairs, if necessary. Immediately after the Lowmoor plate and attaching it to the following tier shall be an expansion-ring of Lowmoor or Bowling iron, and also another one half-way between it and the back of the boiler. There shall also be three Galloway pipes placed diagonally in each tube, equally distributed, and commencing at the back of the first expansion-ring. The whole of the plates in each tube, except the one already specified, shall be of Staffordshire best-best iron, the brand to be visible inside the tube on each plate; and in no case shall there be less than $\frac{3}{4}$-in. of metal between the edge of the rivet-hole and the edge of the lap.

Steam-chest.

The steam-chest shall be 3 ft. diameter, 3 ft. high, and $\frac{1}{2}$-in. thick; to be secured to the boiler by its lower part being flanged; the top to be slightly dished and flanged. There shall not be more than three plates in the steam-chest, including the top, all to be of sufficiently good quality to bear flanging.

Ends of Shell.

The ends of the shell shall each be in one plate, having no seam across, to be $\frac{9}{16}$-in. thick, flanged to fit inside the shell, and secured to the tubes by angle-iron rings 3 in. × 3 in. × $\frac{1}{2}$-in. iron. Each end shall be stayed to the shell with four gusset-stays of $\frac{1}{2}$-in. plate, each to terminate within 8 in. of the angle ring of the tubes; the rivets in the stays to be 4 in. apart.

Man-holes.

There shall be two man-holes; one on the front below the tubes and one on the top of the shell in front of the steam-chest. They shall each consist of a double-flanged wrought-iron ring, $\frac{3}{4}$ in. thick, riveted to the boiler and faced on the outer flange to take the cover, which shall be of cast-iron, $1\frac{1}{4}$ in. thick, and faced and secured to the ring with $\frac{3}{4}$-inch bolts and nuts, 4 in. apart from centre to centre.

Riveting.

All the rivets shall be $\frac{3}{4}$-in. diameter, and of the best quality, and capable of being bent to a right angle cold without breaking. They shall be all 2 in. apart throughout the boiler, viz. from centre to centre, and on no account shall a "drift" be used for making the holes fair.

Caulking.

The whole of the boiler shall be soundly caulked with rod-tools of the dimensions given in 'Sexton's

Pocket-book.' There shall not be any sal-ammoniac, or any other matter used for rusting the iron.

Testing.

The boiler shall be tested with cold water to a pressure of 120 lbs. per square inch in the presence of Messrs. Brown, Jones, and Co.'s representative; and afterwards steam shall be got up or forced in from another boiler to a pressure of 60 lbs. per square inch in the presence of the before-mentioned person, who shall not pass the boiler until it is absolutely tight when subjected to each test.

Fittings.

The boiler shall have a cast-iron-faced seating riveted under the bottom and close to the front, suitable to take a $2\frac{1}{2}$-in. blow-off pipe; the casting to have four slot-holes in its periphery to take T-headed bolts, so that no bolts shall go through the boiler. There shall be another seating riveted to the top of the steam-chest suitable to receive a 3-in. double safety-valve, having six slot-holes, as before mentioned. Each of these seatings shall have a wrought-iron liner or flange between it and the boiler for the purpose of caulking. There shall be two glass water-indicators, with gun-metal fittings, so fixed that the bottom of the glass shall be $2\frac{1}{2}$ in. above the level of the top of the tubes. There shall be a pressure-gauge fixed on the front of the boiler, immediately over the furnace-doors. There shall be a fusible-plug in the top of each tube, directly over the middle bearing-bar. There shall be a cast-iron furnace-front, with

smoke-consuming door to each tube. The front in each case shall be secured to the boiler with three $\frac{7}{8}$-in. studs screwed into the boiler, and caulked; the holes in the casting to be sufficiently large to pass easily over the studs, and fastened with a nut on each stud. There shall be two tiers of cast-iron fire-bars in each tube, with a 6-inch dead plate and two bearing-bars; each end of each bearing-bar to drop into a cast-iron lug, which shall be secured to the sides of the tube with two studs screwed into the plate, and caulked; the lugs to slip easily over the studs and to be easily removable at any time. The boiler, after being finished, shall be properly painted and delivered on the premises of Messrs. Brown, Jones, and Co., free of charge and uninjured from the effects of removal, for the sum of five hundred and eighty-six pounds (586*l.*).

The market price of iron must, of course, govern the price of a boiler; but the above was the actual price charged for the specified boiler by a well-known London firm in the year 1873.

On the Purchase of Second-hand Boilers.

After about twenty years fair working—more or less according to the original quality of the iron and a variety of other circumstances—a structural or molecular change begins to take place in the plates of boilers, that is to say, they gradually begin to change from a wrought or fibrous to a granular or cast-iron, and when this change commences they can no longer be worked with safety. It is indeed true that boilers have

worked well for thirty-five years; but they are like people with diseased hearts, they may live a long time, or they may die with terrible suddenness. If a boiler is found to crack in any portion of it that is not directly exposed to the action of the fire, it is a sign of danger, and the boiler should be replaced by a new one as soon as possible. Great caution should be observed in the purchase of a second-hand boiler; and it is never prudent to buy one, however well it may look, unless the age is known to a certainty.

On the Care and Treatment of Boilers generally.

Have the boiler fitted with the most approved appliances already mentioned for insuring safety, but never rely implicitly on them. The best of all safeguards is an experienced and careful stoker; never employ a man given to levity or practical joking. Cover your boiler with some good non-conducting material. Do not allow wet ashes to accumulate against the front of the boiler. Let the amount of water inside the boiler always be as nearly as possible at the same level. Use some effective composition to prevent incrustation, and never allow incrustation to remain on the top of the tube. Blow a little water out through the blow-off pipe once a day. Try the water-indicators frequently to see that they are not stopped up; have the safety-valves weighted to blow off just over the working pressure when the weights are at the ends of the levers. See that the guides of the safety-valve levers are not stopped up with dirt or paint; have the lever

fastened in its joint with a pin and key, and not with a bolt and nut; the latter may be screwed too tight and prevent the lever from working. See that the safety-valves and the pressure-gauge always agree with each other. Do not allow cocks to drip, or water from any source whatever to drip on the boiler. If a leak is discovered have it attended to at once; and always get the repairs done by the maker unless there are strong reasons to induce you to do otherwise. If the boiler should become short of water, and the top of the furnace is observed to be red-hot, do not run away in alarm; do not stop the engine or turn on the feed at once, or lift the safety-valve levers, but open the furnace-doors, and wait until the pressure goes down a little, and then put on the feed. If such an accident as this should happen, have the boiler examined by a competent person as soon as possible, notwithstanding that it may appear to be uninjured.

Marine Boilers.

Do not allow the bilge-water to wash against the bottom of the boiler. Do not open the smoke-box doors when the boiler is in a heated state. If you have a surface-condenser and a new boiler do not use all condensed water, but use your auxiliary feed until a thin scale forms inside the boiler; there are instances of new boilers having been ruined by injudiciously being kept "*too clean.*" When once the sediment or salt attaches itself to the boiler keep it as clean as possible afterwards; be careful not to allow pieces of cotton-waste to remain in the boiler. Do not

blow the steam and hot water out, and then run the boiler up full of cold water. Never go to sea with a man-hole or mud-hole-joint leaking.

Specification of Two 80-horse power Marine Boilers for Messrs. Smith and Robinson's Steam Ship 'Navarino.'

Shell.

The shells of the boilers shall be 10 ft. 6 in. long at the bottom, and 12 ft. long at the top, by 12 ft. 7 in. wide and 13 ft. 6 in. high; with a steam-chest 7 ft. diameter by 4 ft. high, through which the uptake shall pass. The bottoms of the shells shall be $\frac{1}{2}$ in. thick and double riveted. The back and front of the boilers shall be $\frac{7}{16}$ in. thick, and flanged to fit inside the shell. The sides and top shall be $\frac{3}{8}$ in. thick; all except the bottom to be single riveted in each boiler.

Furnaces.

There shall be four oval furnaces in each boiler, 3 ft. 3 in. high by 2 ft. 6 in. wide, and $\frac{3}{8}$ in. thick. The top and sides shall be of Lowmoor or Bowling iron, and the bottom of Staffordshire best-best. There shall not be any seams above the fire-grate except the seam attaching the back tube-plate to the furnace; the back tube-plates shall be $\frac{9}{16}$ in. thick, and of Lowmoor or Bowling iron.

Combustion-Chambers or Fire-Boxes.

The whole of the combustion-chambers, except the bottoms, shall be of Lowmoor or Bowling iron,

$\frac{3}{8}$ in. thick; the bottom shall be of Staffordshire best-best iron, $\frac{7}{16}$ in. thick. The distance from the bottom of the back tube-plate to the back of combustion-chamber to be 2 ft. 4 in., and from the top of the said tube-plate to the back of the chamber, 2 ft. There shall be two combustion-chambers to each boiler, viz. one to each two furnaces; the top of the combustion-chambers shall be curved, as shown in the tracing.

Uptake.

The front tube-plate shall be $\frac{9}{16}$ in. thick, and of Staffordshire best-best iron. The rest of the uptake shall be $\frac{7}{16}$ in. thick, and of Staffordshire best-best iron. There shall not be any flat surfaces in the uptake above the tubes.

Tubes.

There shall be 218 tubes of $3\frac{3}{4}$ inches external diameter and of No. 9 gauge. The front end of each tube shall be $\frac{1}{16}$ in. larger in diameter than the back end, so as to pass easily through the front plate without driving. There shall be stay-tubes within 1 ft. 6 in. of each other, screwed into the back tube-plate, and fastened to the front plate with two nuts on each stay-tube; these stay-tubes shall be $3\frac{3}{4}$ inches external diameter by $\frac{5}{16}$-in. thick. Pitch of thread to be 11 to the inch.

Stays.

The sides of the boiler shall be secured to the sides of the furnaces, with two rows of $1\frac{1}{4}$-inch stays screwed into the shell and furnaces, and

riveted at both ends. The sides of the furnaces shall be secured to each other in the same manner, and with the same sized stays. The sides and backs of the combustion-chambers shall be stayed to the sides and back of the shell, and to each other with the same sized stays, all riveted. All the $1\frac{1}{4}$-in. screwed stays shall be pitched in squares of not more than 10 inches from centre to centre. The remaining portion of the sides and back of each boiler shall be strengthened with bars of $3 \times 3 \times \frac{1}{2}$-in. angle-iron, not more than 15 in. from each other, and a bar of $1\frac{1}{2}$-in. square iron, or iron of equal sectional area (not round), at intervals of 15 in., with a T-end $3 \times \frac{5}{8}$-in. riveted to the angle-iron with four $\frac{3}{4}$-in. rivets in each end; these stays to be fixed across, and longitudinally in the boilers as shown in the accompanying tracing. The bottom of each furnace shall be secured to the bottom of the shell with brackets 15 in. apart, with four $\frac{3}{4}$-in. rivets in the bottom of the shell, and four $\frac{3}{4}$-in. rivets in the bottom of the furnace to each bracket. Between each two furnaces shall be two bars of $4 \times 3 \times \frac{1}{2}$-in. angle-iron, the 3-in. flange riveted to the bottom of the boiler, $1\frac{1}{2}$ in. clear between the bars, which shall extend the full length of the bottom; and stays of $1\frac{1}{2}$-in. square iron from bottom to top of boiler at intervals of 15 in., secured at each end with a $1\frac{1}{4}$-in. pin and split-key; the front of the shell shall be stayed like the sides.

Man- and Mud-holes.

There shall be three man-holes on the front of each boiler, as near 16 in. by 12 in. as possible,

and one man-hole on the top of the boiler, 16 in. by 12 in. Each man-hole shall be strengthened by a wrought-iron ring of 3 in. × $\frac{5}{8}$-in. iron, riveted on the outside; the inside to be countersunk. The man-hole doors shall fit inside the boiler, and each shall have two wrought-iron crossbars, two $1\frac{3}{8}$-in. studs, with square nuts, and a wrought-iron handle in the middle of each door. There shall be three mud-holes in the front and three in the back of each boiler, as near the bottom as convenient; the size to be 8 in. × $5\frac{1}{2}$ in. each, to be strengthened with a ring of $2\frac{1}{2}$ in. × $\frac{1}{2}$-in. flat iron. The mud-hole doors to fit inside the boiler, each to have one wrought-iron cross-bar, one $1\frac{1}{8}$-in. stud, with square nut. There shall not be any cast-iron connected with the man-holes or mud-holes, and all the doors shall fit their places within $\frac{1}{16}$ in.

Smoke-box Doors.

There shall be four smoke-box doors to each boiler, with two wrought-iron hinges $\frac{3}{8}$-in. thick to each door. Each door shall consist of a $\frac{3}{16}$-in. plate, with a $\frac{3}{16}$-in. guard-plate inside and a $\frac{1}{8}$-in. plate outside; the three to be secured together with $\frac{1}{2}$-in. rivets, 9 inches apart, and ferrules between, $1\frac{1}{2}$ in. long. There shall be also two wrought-iron handles of $\frac{7}{8}$-in. round iron, with efficient catches, and a ring-bolt of $\frac{5}{8}$-in. round iron, with a $\frac{3}{4}$-in. shank to each door.

Riveting.

.The rivets shall be all of the best quality, and capable of being bent cold to a right angle

without breaking. They shall be all $\frac{3}{4}$-in. diameter, and of the dimensions and pitch given in 'Sexton's Pocket-book;' and in no instance shall a drift be used for the purpose of making the holes fair.

Caulking.

The shell of the boilers shall be soundly caulked on the outside with rod caulking-tools of the dimensions given in 'Sexton's Pocket-book,' and the fire-boxes and combustion-chambers shall be caulked on the inside. There shall not be any sal-ammoniac or any other matter used for rusting the iron.

Countersinking.

All holes necessary to be countersunk shall be countersunk with a tool made to an angle of 60°, and $\frac{1}{4}$ the thickness of the metal shall be left parallel in each hole.

Furnace-fronts and Fire-bars.

There shall be a cast-iron front to each furnace, perforated with 1-in. holes, 5 inches apart all over, and fitted with cast-iron guard-plates inside, perforated with $\frac{1}{2}$-in. holes, 3 inches apart. The fronts shall be secured to the boiler with four $\frac{7}{8}$-in. studs to each, screwed into the boiler and caulked. The holes in the castings shall be sufficiently large, so that the expansion of the metal does not break the studs off. Each stud shall have a square nut. There shall also be a smoke-consuming door to each front of cast-iron, the hinges of which shall admit of a $\frac{7}{8}$-in. pin; each door shall have a wrought-iron latch and guard. There shall be

two tiers of cast-iron fire-bars, 2 ft. 6 in. long each, and a cast-iron dead-plate, 8 inches wide, in each furnace. The dead-plate shall be secured to the furnace-front with two $\frac{3}{4}$-in. bolts and nuts, and also be supported by two 1-in. studs, tapped into the furnace-sides and caulked. There shall be two bearing-bars to each furnace, fitting in cast-iron lugs, each of which shall be secured to the furnace by two $\frac{3}{4}$-in. studs, tapped in and caulked, and having square nuts. The holes in the lugs shall be sufficiently large to pass very freely over the studs. Finally, the boilers shall be in accordance with the accompanying tracing; and wherever the sentence "*the boiler*" occurs, it shall be understood to mean each or both boilers.

Testing.

The boilers shall be tested in the presence of some person, appointed by Messrs. Smith and Robinson, with cold water to a pressure of 50 lbs. per square inch, and afterwards steam got up to 40 lbs. per square inch, and the boilers shall not be passed unless absolutely tight at each test. After being passed the boilers shall be thoroughly cleansed from rust, and receive each two coats of pure red lead, and be afterwards delivered free of charge and uninjured in any dock on the river Thames, for the sum of eight hundred and twenty-five pounds each (825*l.*).

Where to look for Defects in Boilers.

Lancashire and Cornish Boilers.

When you receive a new boiler, first look at the bottom and see that it is not damaged by being

moved on common rollers. If such has occurred, there will be hollows or flat places in the plates.

Examine the man-holes; see that they have not been strained or damaged by having "toggles" put across them for the purpose of moving or lifting the boiler.

See that blocks or pieces of wood have not been left inside, between or under the furnaces or tubes.

Examine all round the bottom flange of the steam-chest to see that it has not been cracked in riveting; and examine the same inside the boiler to see that it has not been filled up with iron cement, which is sal-ammoniac and cast-iron borings. This is commonly done by bad workmen to conceal a crack in the bottom flange of steam-chests, and will frequently enable them to pass unobserved under the cold-water test, but generally gives way to some extent when steam is got up.

Examine the angle-iron rings round the ends of the tubes, between the rivet-heads, especially under the bottoms of the tubes; see that there are not any cracks running from rivet to rivet.

Examine the gusset-stays at the ends of the boiler; see that the rivets are not loose, and that they are all one size. It often happens that those stays are put in by boys and bad workmen; that the holes are unfair; that the riveters cannot put the proper sized rivets in the holes, and therefore put in anything that will go in, thinking as they are out of sight that they are of no consequence.

See that the water-indicators are properly fixed,

and that bits of red lead are not stuck in the holes.

See that the bearing-bars are the proper length, and not likely to drop out when the boiler is at work; and see that there is room for the fire-bars to expand when they become heated.

See that the blow-off cock does not leak.

See that the safety-valve levers will lift up and down easily.

Where to look for Defects in Marine Boilers.

Examine carefully all the plates exposed to the action of the fire, and see the Lowmoor or Bowling brand plainly on them. Lowmoor iron is stamped Lowmoor; and Bowling iron is stamped Bowling, Yorkshire. There is another brand closely resembling one of these, but the quality of the iron bears no comparison to either.

Look at the ends of the screwed stays; see that they are not put through a seam of rivets by mistake; sometimes a stay is screwed through a rivet-hole, but that is no harm.

Examine the ends of the tubes, and see if pieces of hoop iron have been put round any, where the holes had been bored too large. Also see that the tubes are not too short; they should all project some distance through the tube plate (about $\frac{1}{4}$ in.).

See that pieces of wood or anything else have not been left inside the boiler; see that the fire-boxes are not jammed against the shell at the

back, or under the bottom, or where the side o the shell begins to take a curved form.

Examine all the internal stays; see that they are all straight, and not bent to clear anything; see that they are not fractured where they have been welded; see that the rivet-heads in them are all of one size and not loose (if they are riveted); see that all the pins are in the holes, and the keys in the pins, particularly at the bottom; and notice the stays between the tubes, that they are "fair between the tubes," and not straining on any of them; and see that the stays appear all to be equally tight. If they are all slightly flexible when pulled with the hand they will do; but if some are quite rigid and others rather loose they are not at all safe.

Accidents through Bad Workmanship that have come under the Personal Observation of the Author. The Names of the Firms where the occurrences took place are, for obvious Reasons, omitted.

A large vertical boiler, the fire-box of which was made 6 in. less in diameter at the top than the bottom, burst in testing. The cause was this: the man who made the templates of the fire-box either gave too little camber or not any at all. The fire-box was made in four large plates, with a seam of rivets running round the centre; the two bottom plates were of Lowmoor iron, but not the two upper ones. When the four plates were put together the holes in the central seam were found to be very unfair, in consequence of the want of

camber; the plater, however, got them passably fair by driving a drift in every third or fourth hole, and letting the seams go a little bad vertically. The fire-box, however, could not be made to retain a circular shape, only when shored out forcibly. Shores were kept across whilst it was being riveted, until one of the men noticed a crack commencing in the lower edge of one of the upper plates; the shores were then removed, it being partially riveted, and it was allowed to go as much out of shape as it would. The boiler was eventually finished, and tested in the usual way with cold water to 80 lbs. per square inch. It was intended to be tested to 100 lbs., but it leaked too rapidly to get more than 80 lbs. on. The water was then removed, the leaks caulked, and another attempt made to get the full pressure on. But a little while after the gauge indicated 93 or 94 lbs. pressure, four of the screwed stays gave way with a loud report; the circular seam in the fire-box became torn to the extent of about 2 ft. in length, bulging inwards some inches, and in a few seconds the boiler was half emptied. Had this explosion occurred under pressure of steam instead of cold water, the consequences would undoubtedly have been most serious.

A Cornish boiler, 5 ft. diameter, had its ends fastened to the shell by means of internal angle-iron rings, 3 in. × 3 in. × $\frac{3}{8}$ in. The foreman boiler-maker gave the size of the plates required; and ordered the circular plates for the ends too small in diameter, but not very much, perhaps $\frac{5}{8}$ in. To cover his error, he caused the holes to be punched a little towards the centre of the

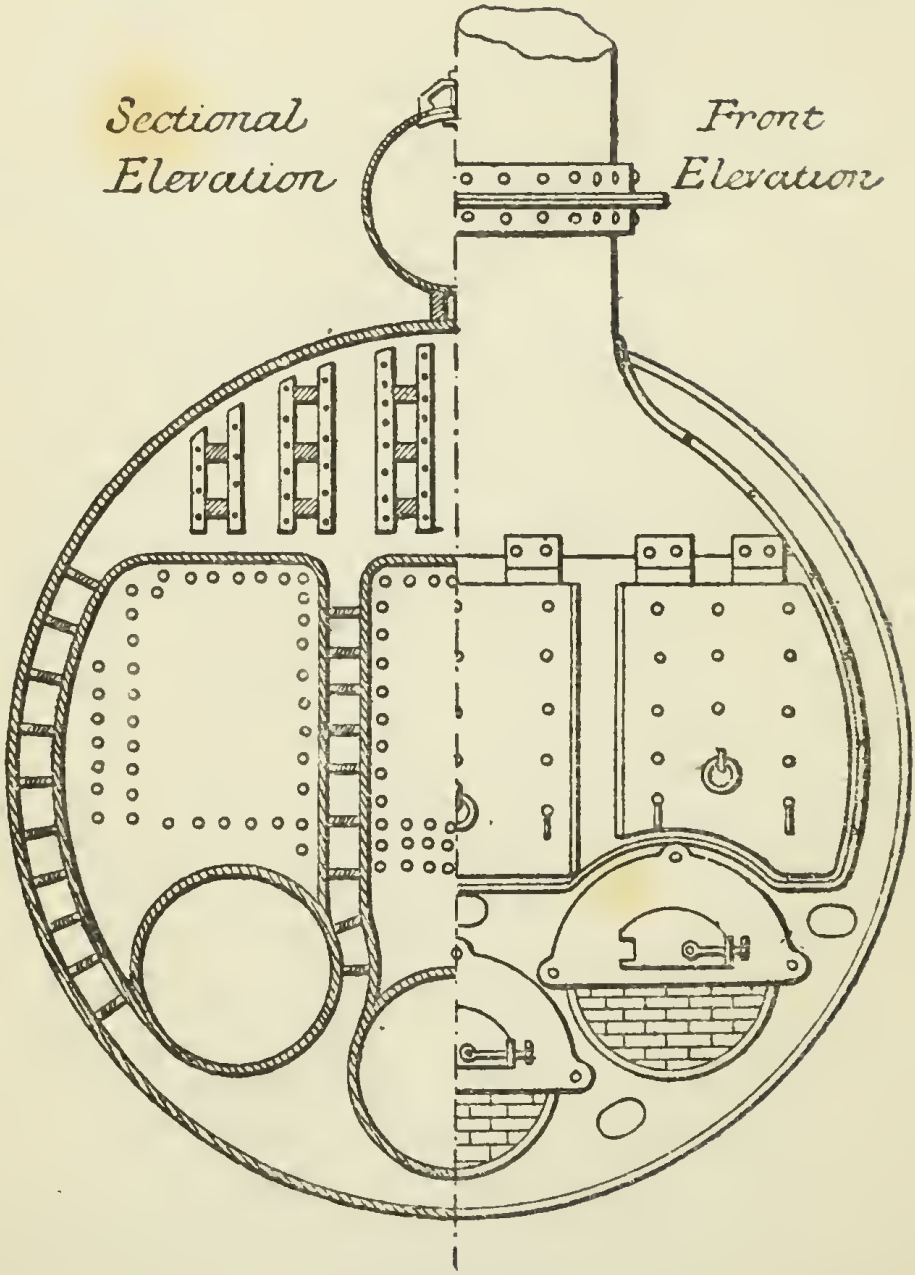
plates all round; and when put together, they were what is termed "half-holes," viz. only half-fair with the holes in the angle-ring, or nearly so. In order to make the rivets go in, the riveters rimered them a little, and then drifted them violently, causing the angle-rings to crack slightly all round. The foreman cautioned the men previously not to crack the rings; and when they were found to be cracked afterwards, the men remained silent on the matter. The boiler was tested to 100 lbs. per square inch, cold-water pressure; and although, with much difficulty, the rivets in the damaged rings were made moderately tight, the boiler was put to work; but after about six months the rings were found to be cracked in such an alarming manner, that the engineer in charge refused to allow the boiler to be worked any longer. The tube accordingly was taken out of the shell, the rings cut out, and new ones made of wider angle-iron ($3\frac{1}{2}$-in.) A variety of opinions existed as to the cause of those fractures amongst persons not aware of their origin.

A marine boiler had its cross-stays, viz. those running from side to side, between the tubes, badly arranged, so that in putting in the tubes it was found necessary to bend them. To make them clear the stays, they were not bent quite enough, and the stays had to be pressed down to get the tubes in. Those tubes leaked very much in testing. They were made tight with the pressure on the boiler; but when the pressure was removed, and again applied, they leaked again. The boiler was, however, passed in this condition. The foreman boiler-maker in this instance was

not aware of the bending of the stays and tubes, or the fact of the stays not fitting properly between the tubes,

A Cornish boiler, 25 ft. long, was stayed by means of three long stays of $1\frac{1}{2}$-in. round iron, running from end to end, and secured to the ends of the shell by means of two pieces of 3-in. × 3-in. × $\frac{3}{8}$-in. angles, 8 in. long each, and a $1\frac{1}{2}$-in. hole drilled in them with a pin through the ends of the stays. The ends of the shell were $\frac{7}{16}$ in. thick. At a pressure of a few pounds under 100, a loud report was heard in the boiler, and was quickly followed by another, and by the bulging outwards of the ends of the shell. It was found, upon investigation, that the central stay was broken at the weld, where it was also thinnest; and that in the case of the other two stays, the pins had been dragged through the angle-irons, which were too thin and too narrow in their flanges. Had this occurrence taken place with a pressure of steam on the boiler, an explosion would most probably have followed the breaking of the stays. Several other instances could be mentioned, such as steam-chests tearing round their bottom flanges through being improperly cut out for flanging, &c.; but our space is limited, and the foregoing will probably be sufficient to show that great care is at all times necessary in the construction of steam-boilers; and the number of explosions of comparatively new boilers that have recently occurred must be fresh in the recollection of many persons. Some of those explosions, I have not the slightest doubt, had their origin in defective workmanship.

High Pressure Cylindrical Marine Boiler.



Dimensions.

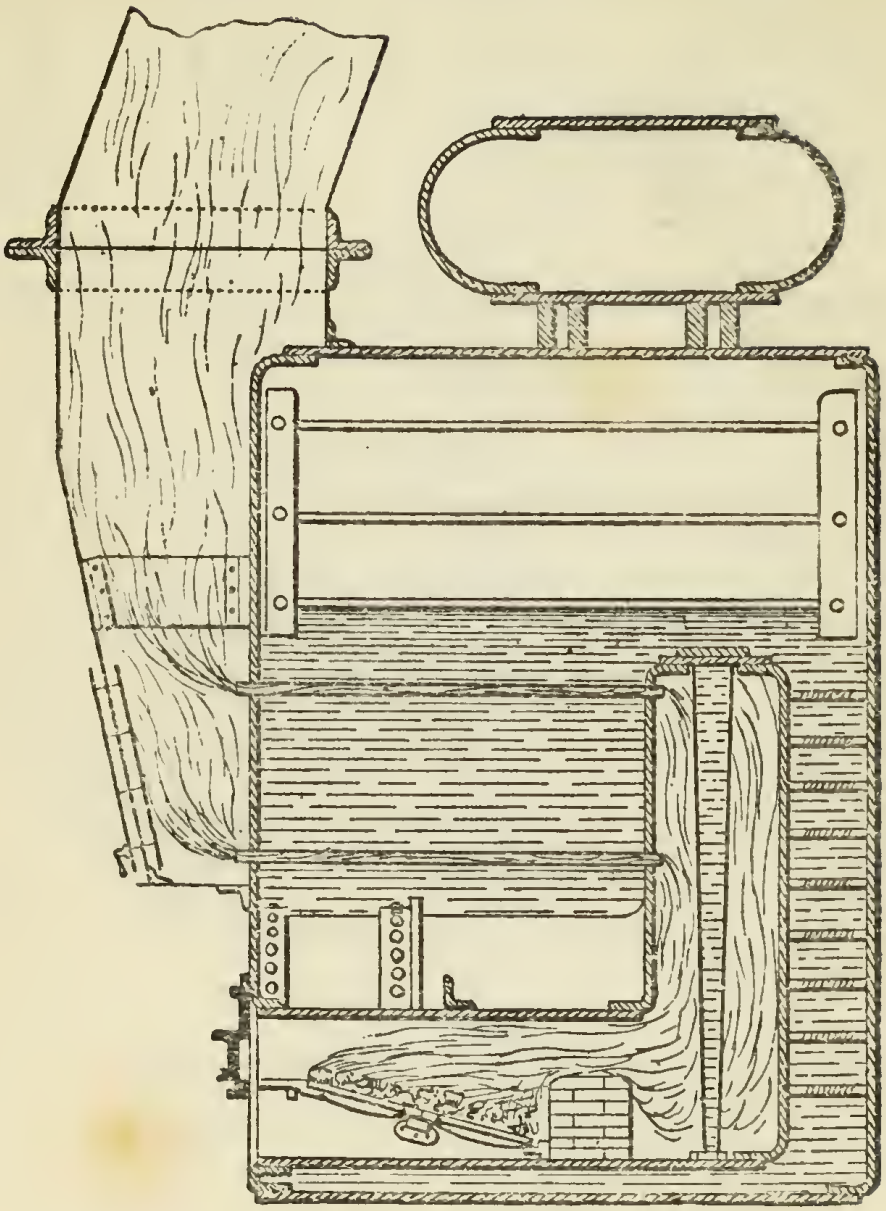
15 feet diameter. 10 feet 6 inches long.

This Boiler was double riveted on the outside, and weighed 28 tons 3 cwt. It contained 240 3½-inch tubes.

Made by Messrs. Samuel Hodge and Sons, Millwall.

High Pressure Marine Cylindrical Boiler.

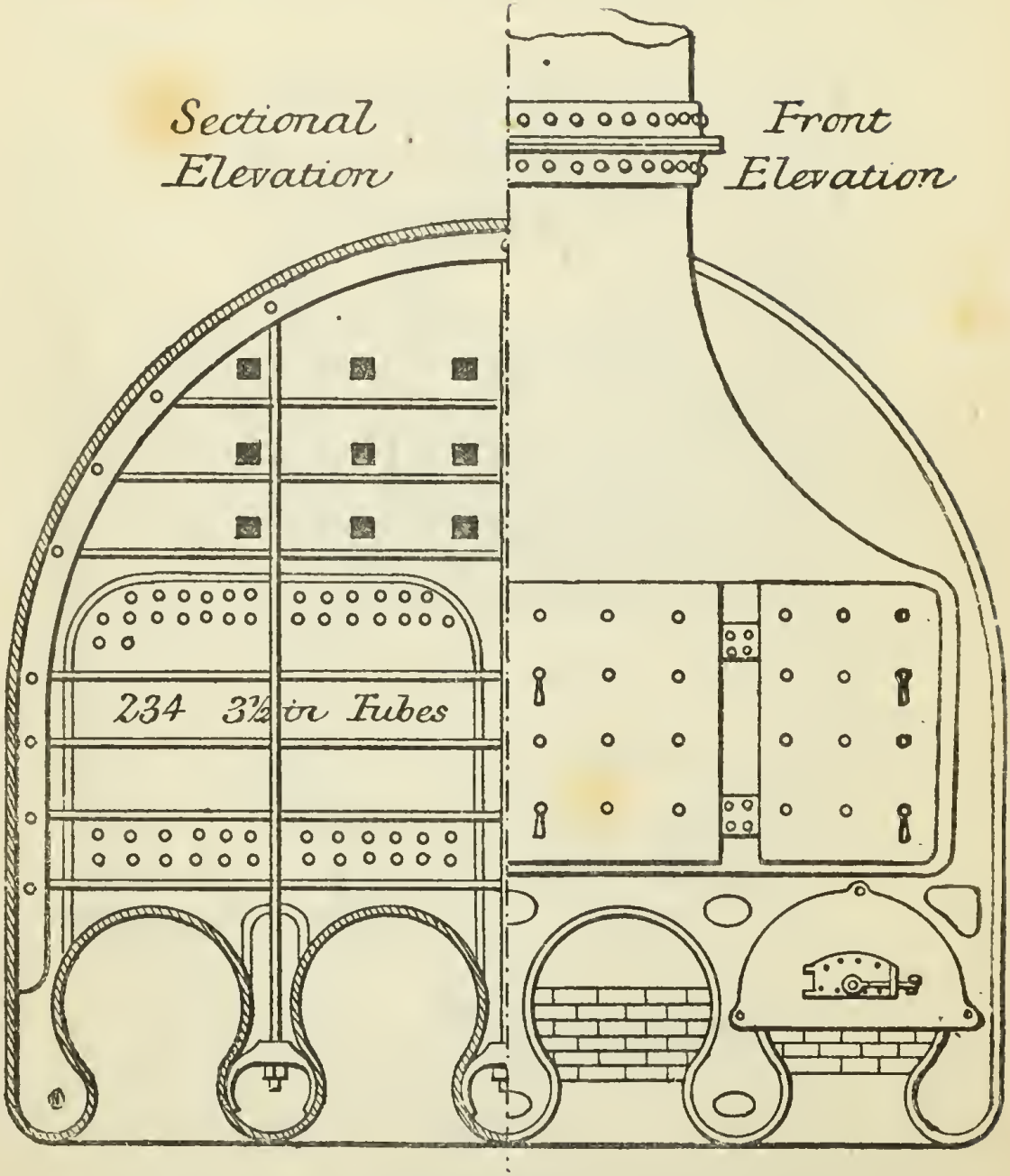
Longitudinal Sectional Elevation.



The top and bottom row of tubes only are shown. The shading indicates the water-level.

Made by Messrs. Samuel Hodge and Sons. Millwall.

Dry or Open Bottomed Boiler for an Ocean-going Steamship.



Dimensions.

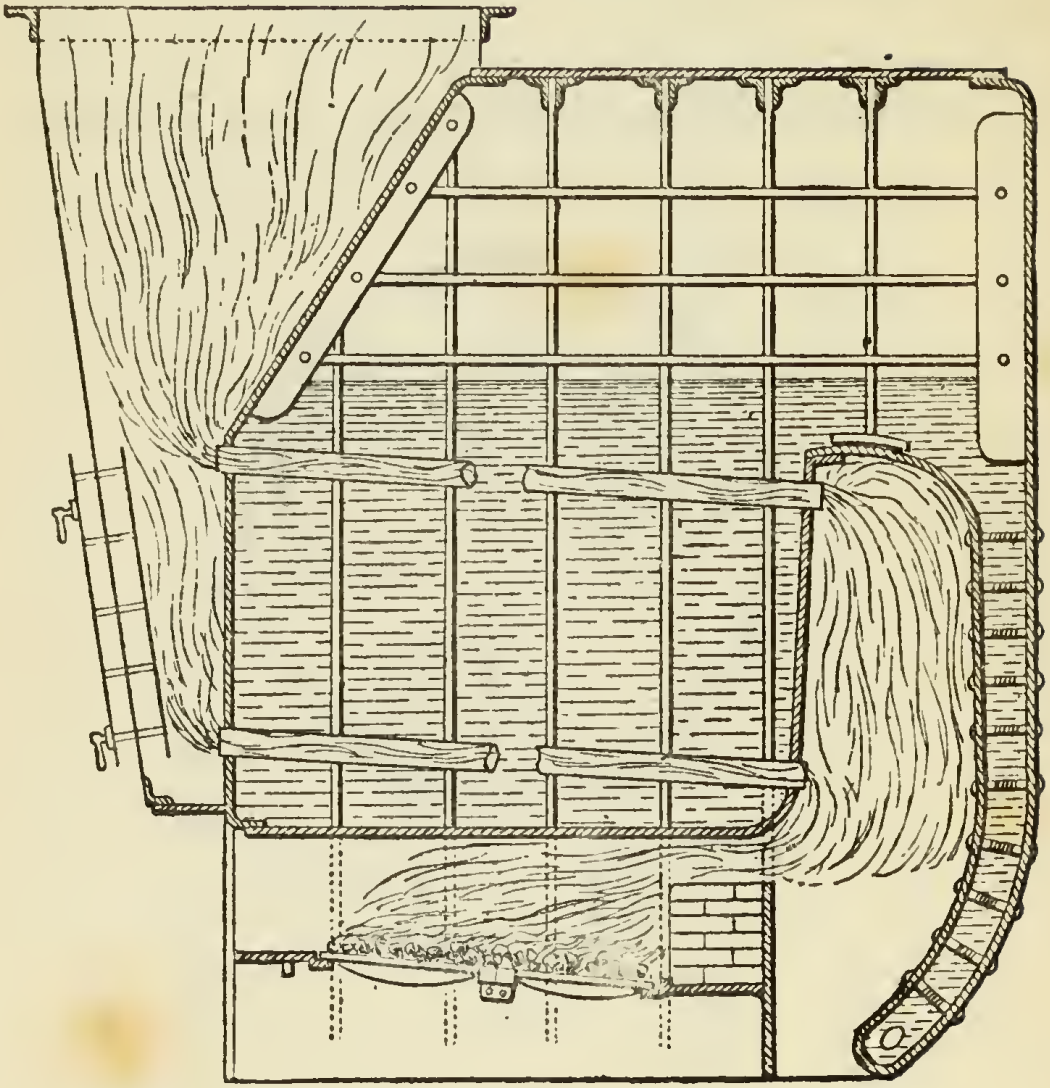
Height, 13 ft. 6 in. Width, 14 ft. 6 in. Length, 10 ft. 2 in. at bottom, and 13 ft. 2 in. at top.

This boiler was entirely double riveted on the outside, and weighed 28 tons 7 cwt. when finished.

Made by Messrs. John Stewart and Son, Blackwall.

Dry or Open Bottomed Boiler for an Ocean-going Steamship.

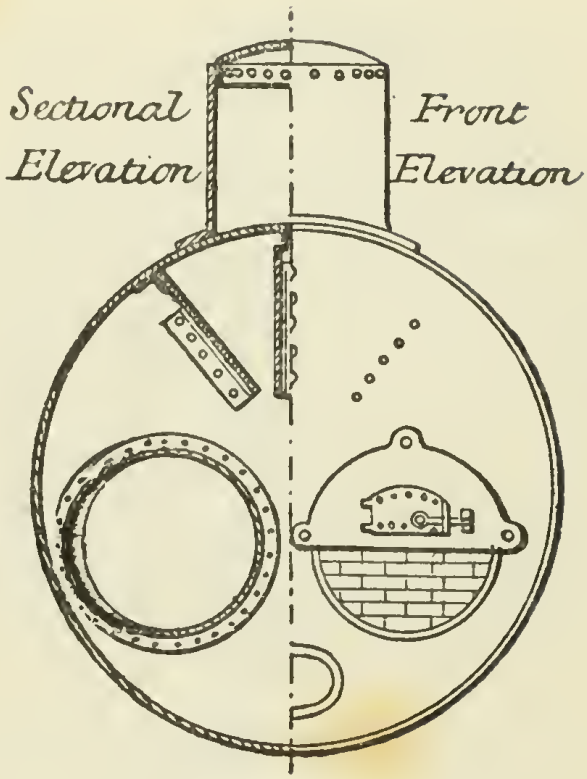
Longitudinal Sectional Elevation



The whole of the tubes are not shown, as the positions of the top and bottom rows will be sufficient.

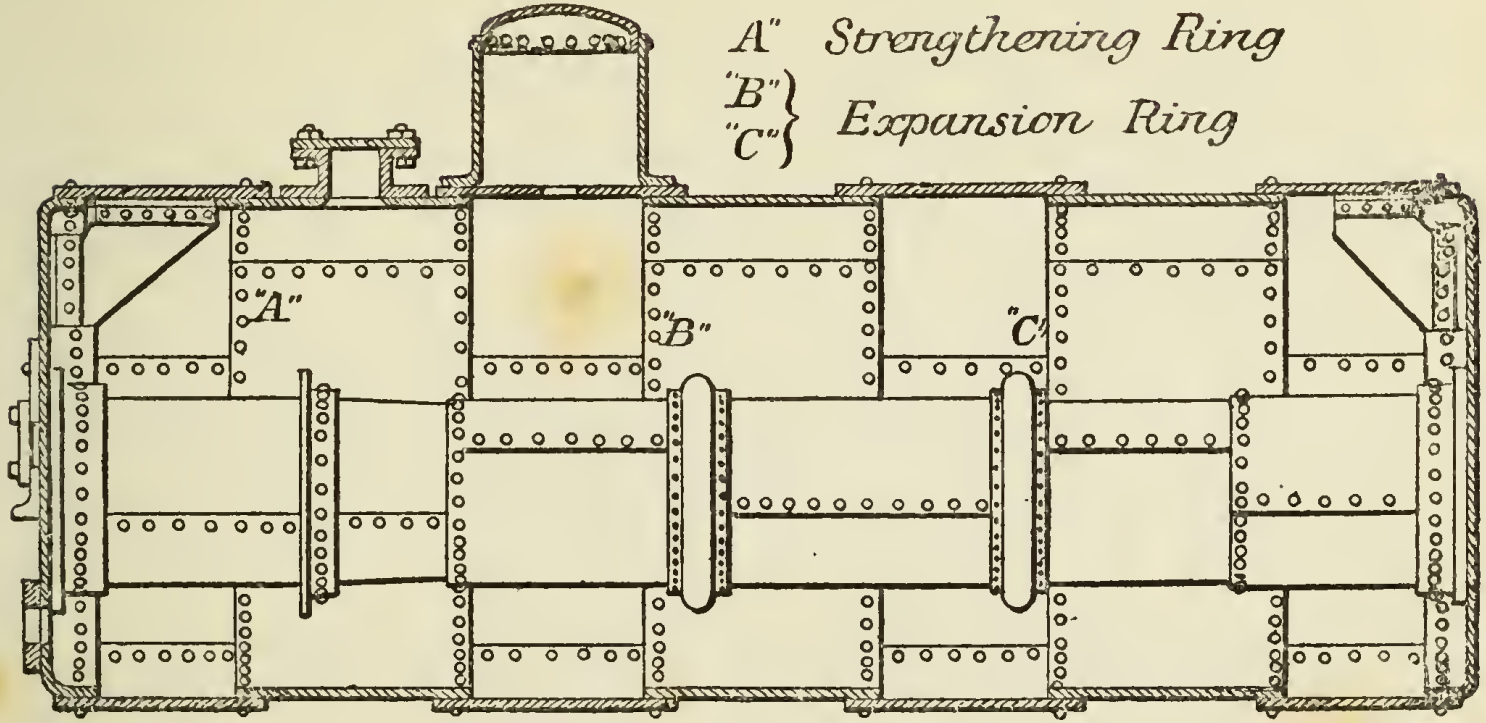
Made by Messrs. John Stewart and Son, Blackwall.

Lancashire or Double-flued Boiler.



Made by Messrs. Eastons and Anderson, Erith, S.E.

Longitudinal Section of Lancashire or Double-flued Boiler.



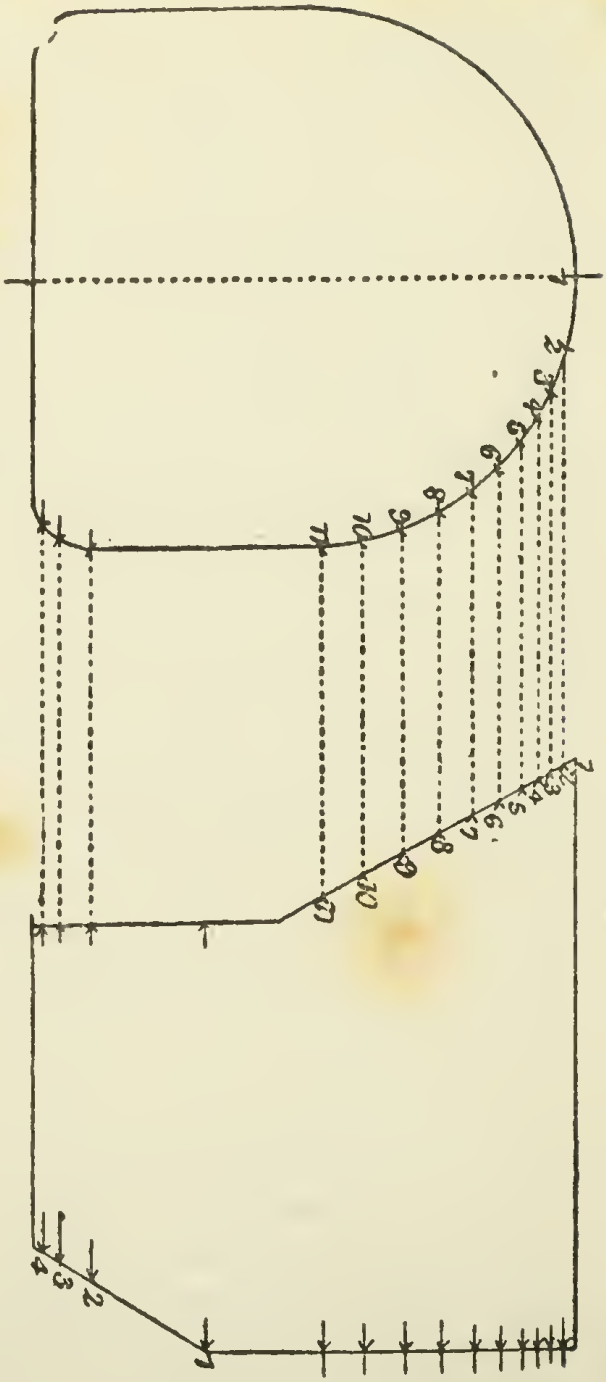
Made by Messrs. Eastons and Anderson, Erith, S.E.

On the Priming of Boilers.

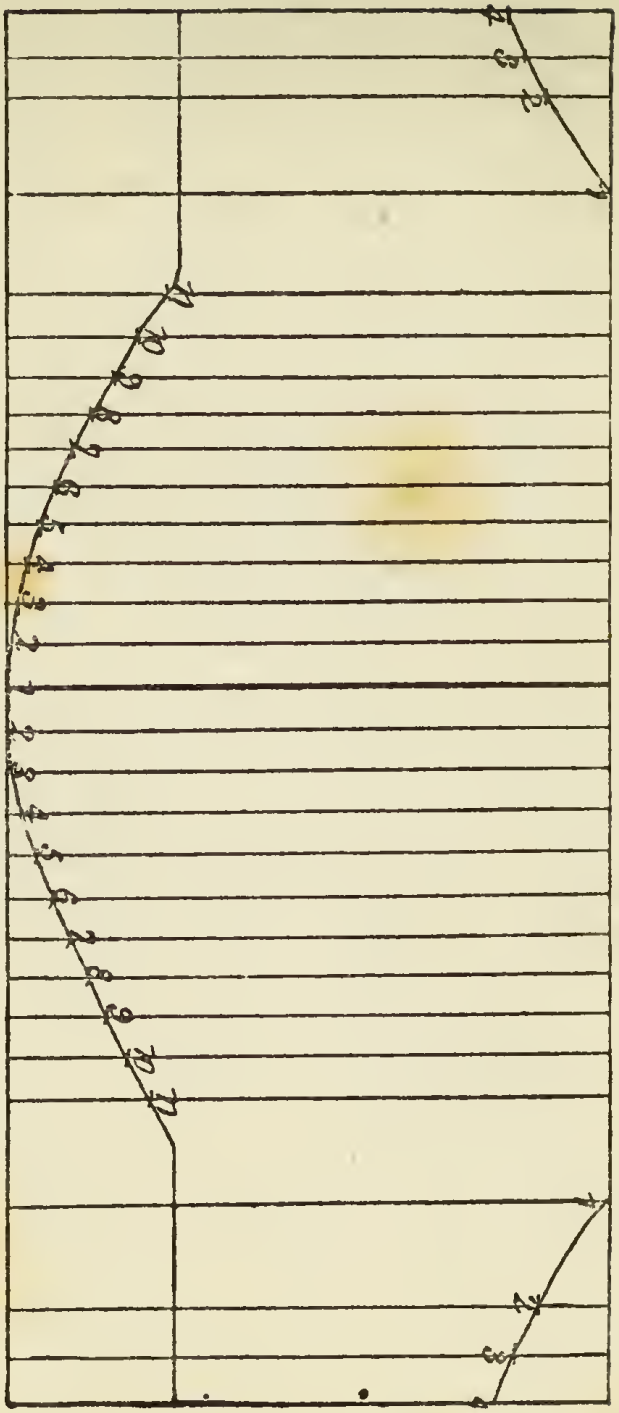
When water passes from the boiler to the engine along with the steam it is called priming; and the fact that boilers do prime is perfectly well known, but the cause of the occurrence is not by any means clearly understood. Some boilers prime more than others; and dirty water has a greater tendency to priming than clean water Again; new boilers have been known to prime considerably until they become coated inside with scale, and then no longer to do so. Pouring oil or tallow into the boiler has sometimes caused priming to cease, and in other cases boilers so treated have primed much worse than before. Various theories have been set up to account for this action of the water; but it does not appear to have occurred to any one that priming is a sort of water-spout, caused by a whirl in the escaping steam, such as you will see in a tank or tub when water is running out through a hole in the bottom. If your boiler primes, have a wooden grating made about 2 ft. square, or any size to suit your boiler. The grating can be easily made by fastening pieces of wood across each other, so as to leave holes between about $1\frac{1}{4}$ in. square. The size of the laths might be $1\frac{1}{4}$ in. $\times$ $\frac{3}{8}$ in. Fix this grating with three or four pieces of jack-chain, or any convenient way, so that it will float immediately under the aperture whence the steam passes out of the boiler, and it will effectually stop the priming.

Laminations in Boiler-Plates.

When plates are not solid in one piece, but in layers, like the leaves of a book, they are said to be laminated. For many purposes the fact of a plate being laminated is of no great consequence; but the chief evil is, that if any portion of a plate is exposed to the action of the fire, and that portion is laminated, say in two layers, the layer next the fire, not having water on the other side to keep it cool, will expand with the heat, and form a blister, which will crack very quickly: therefore the place where this occurs will be the thickness of the blister, thinner than before, and consequently weaker; and if this thinness extends over a large area there is, of course, danger of its bursting. Plates that are intended to be placed near the fire in boilers, especially if they are not of the quality already recommended, should be sounded before being used. The way to sound a plate is as follows:—first line the plate out in squares of about a foot each; then with a hand-hammer (a light one, say $1\frac{1}{4}$ lbs. weight) hammer each square separately, and, as you do so, chalk them, so as not to go over the same ones again. If the plate is of good solid iron it will sound clear, and the hammer will fall heavy on it; but if it has a tendency to blister, it will give a dull sound, and the hammer will rebound as if dropped or struck on a spring. Both sides of the plate should be tested in this manner. Sometimes a plate will appear to be quite sound on one side, but will, nevertheless, be found defective on the other. A few blows in each square will be sufficient.

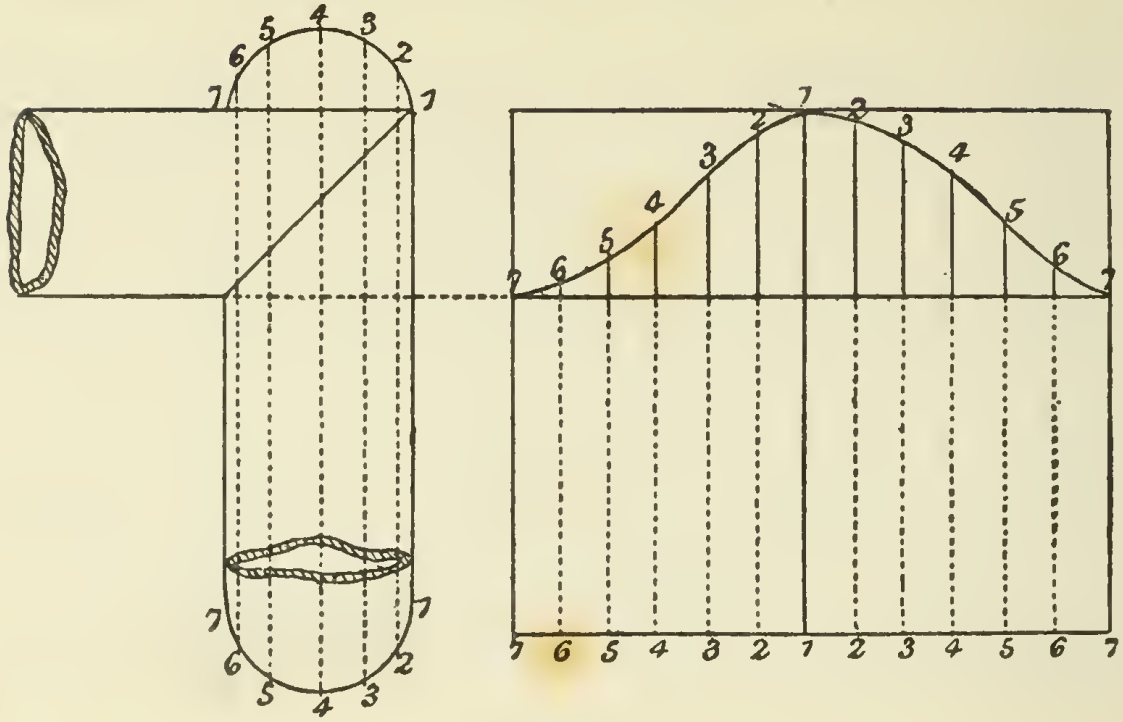


DEVELOPMENT OF MARINE BOILER.



DEVELOPMENT OF MARINE BOILER—*continued.*

Development of Elbows, &c.



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Boiler-making is one of the most laborious of all occupations, and it has developed a peculiar race of men. It has been said that there is a freemasonry in every craft by which its members can recognise each other under any circumstances, and of boiler-makers this is especially true. The character of what is called "the boiler-maker," which includes iron-ship builders, tank-makers, iron-mast, and yard-makers, &c., is very like that in which novelists generally depict the British sailor. He, the boiler-maker, is by nature, or, what is next to it, habit, a lover of hard work. Accustomed from his earliest childhood to physical exertion, he is never happier than when his muscular power is in full play; and there are no class of workmen with whom a good word and fair dealing will go a greater way. They may be readily recognised by their spirit of blunt honesty and prompt generosity. There are forty-three thousand and fifty boiler-makers in the United Kingdom; out of which number fourteen thousand three hundred and fifty of the most intelligent and best workmen are embodied in a society, called the United Society of Boiler-makers and Iron-Ship Builders. They (the whole number) earn the annual sum of four millions one hundred and forty-two thousand two hundred and seventy-six pounds. This money is generally laid out as soon as earned, and is therefore kept in continuous circulation.

RATE OF WAGES OF BOILER MAKERS IN THE PRINCIPAL TOWNS IN THE UNITED KINGDOM RECEIVED WEEKLY.

	Angle-iron Smiths.			Platers.			Riveters.			Caulkers.			Holders.		
	£	s.	d.	£	s.	d	£	s.	d.	£	s.	d.	£	s.	d.
London .	2	2	0	2	0	0	1	15	0	1	12	0	1	5	0
Manchester	2	0	0	1	18	0	1	14	0		..		1	10	0
Liverpool.	1	18	0	1	16	0	1	12	0	1	12	0	1	5	0
Bristol. .	1	18	0	1	16	0	1	12	0	1	10	0	1	3	0
Hull .	2	2	0	1	18	0	1	12	0	1	12	0	1	6	0
Newcastle	1	16	0	1	14	0	1	10	0	1	8	0	1	2	0
Devonport	2	2	0	2	0	0	1	13	0	1	13	0	1	3	0
Sheerness.	1	18	0	1	18	0	1	13	0	1	6	0	1	3	0
Brighton .	2	0	0	1	18	0	1	14	0	1	10	0	1	5	0
Glasgow .	1	15	0	1	15	0	1	10	0	1	10	0	1	1	0
Dublin .	1	18	0	1	16	0	1	12	0	1	10	0	1	2	0
Cork . .	1	19	0	1	16	0	1	10	0	1	8	0	1	4	0
Belfast .	1	18	0	1	16	0	1	10	0	1	10	0	1	4	0
Waterford	1	13	0	1	12	0	1	10	0	1	5	0	1	1	0
Erith . .	2	2	0	2	0	0	1	14	0	1	14	0	1	6	0
Dover . .	2	4	0	2	0	0	1	16	0	1	16	0	1	4	0

Table of the Extreme Weights that Bolts will safely Carry.

Diameter of Bolt in Inches.	Diameter at Bottom of Thread.	Area at Bottom of Thread.	Number of Threads per Inch.	Extreme Safe Load.			
				tons.	cwts.	qrs.	lbs.
$\frac{3}{8}$	·295	·0683	16·	0	3	0	5
$\frac{7}{16}$	·346	·0940	14·	0	4	0	22
$\frac{1}{2}$	·393	·1213	12·	0	5	1	8
$\frac{5}{8}$	·509	·2034	11·	0	9	0	19
$\frac{3}{4}$	·622	·3038	10·	0	13	2	7
$\frac{7}{8}$	·733	·4219	9·	0	18	3	9
1	·840	·5541	8·	1	4	2	26
$1\frac{1}{8}$	·942	·6969	7·	1	11	0	12
$1\frac{1}{4}$	1·067	·8941	7·	1	19	0	0
$1\frac{3}{8}$	1·162	1·0604	6·	2	7	1	1
$1\frac{1}{2}$	1·287	1·3009	6·	2	18	0	8
$1\frac{5}{8}$	1·369	1·4720	5·	3	5	2	24
$1\frac{3}{4}$	1·494	1·7530	5·	3	18	1	1
$1\frac{7}{8}$	1·590	1·9855	4·5	4	8	2	15
2	1·715	2·3100	4·5	5	3	0	14
$2\frac{1}{4}$	1·930	2·9255	4·	6	10	2	11
$2\frac{1}{2}$	2·180	3·7325	4·	8	6	2	14
$2\frac{3}{4}$	2·384	4·4637	3·5	9	19	1	2
3	2·634	5·4490	3·5	12	12	0	21
$3\frac{1}{4}$	2·856	6·4013	3·25	14	5	3	27
$3\frac{1}{2}$	3·106	7·5769	3·25	16	18	1	0

Table of the Extreme Weights that Bolts will safely carry.

Diameter of Bolt in Inches.	Diameter at Bottom of Thread.	Area at Bottom of Thread.	Number of Threads per Inch.	Extreme Safe Load.			
				tons.	cwts.	qrs.	lbs
3¾	3·523	8·6726	3·	19	17	1	0
4	3·573	10·0266	3·	22	7	2	12
4¼	3·805	11·371	2·875	25	7	2	15
4½	4·055	12·914	2·875	28	16	2	12
4¾	4·284	14·414	2·75	32	3	1	26
5	4·534	16·416	2·75	36	1	0	18
5¼	4·762	17·810	2·625	39	15	0	10
5½	5·012	19·729	2·625	44	0	3	1
5¾	5·238	21·548	2·5	48	11	1	24
6	5·488	23·654	2·5	52	15	3	26

This Table of safe loads is calculated at one-tenth of the breaking strain.

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